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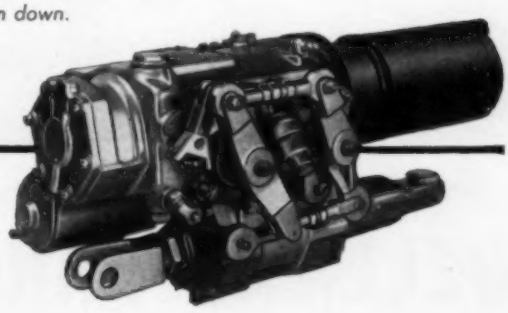

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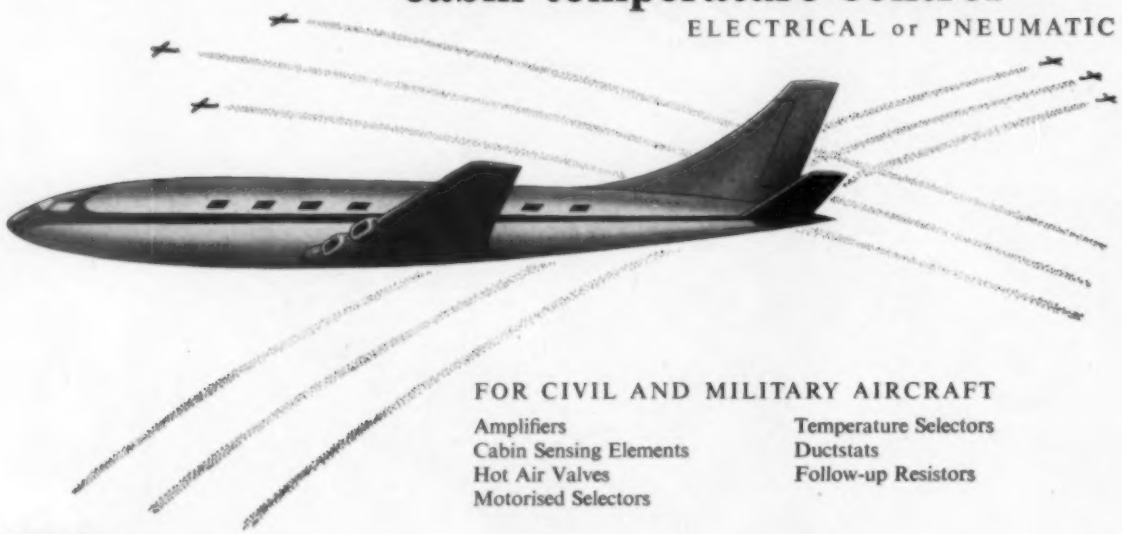

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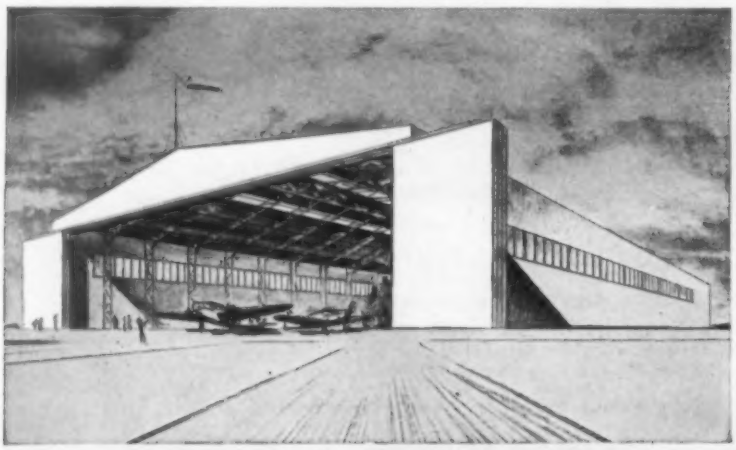

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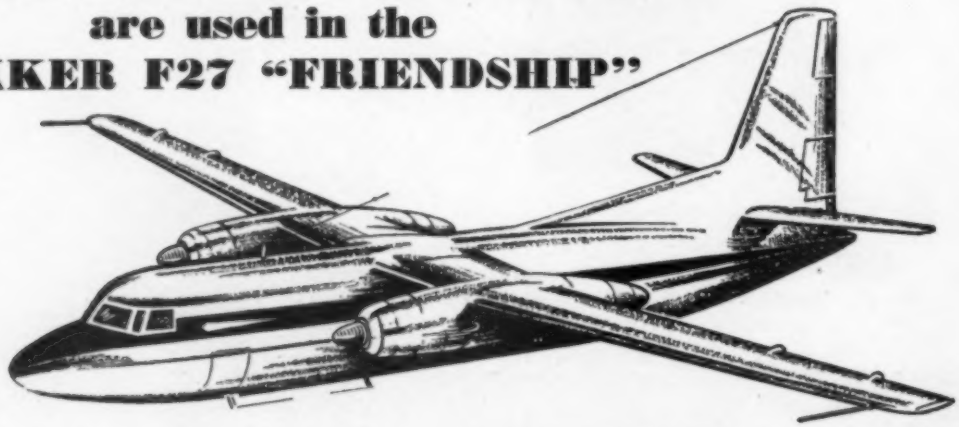

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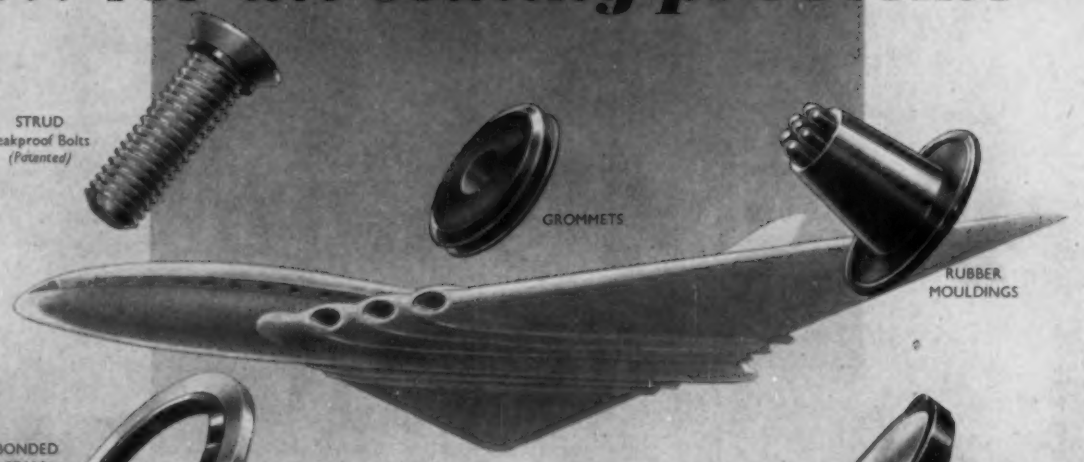

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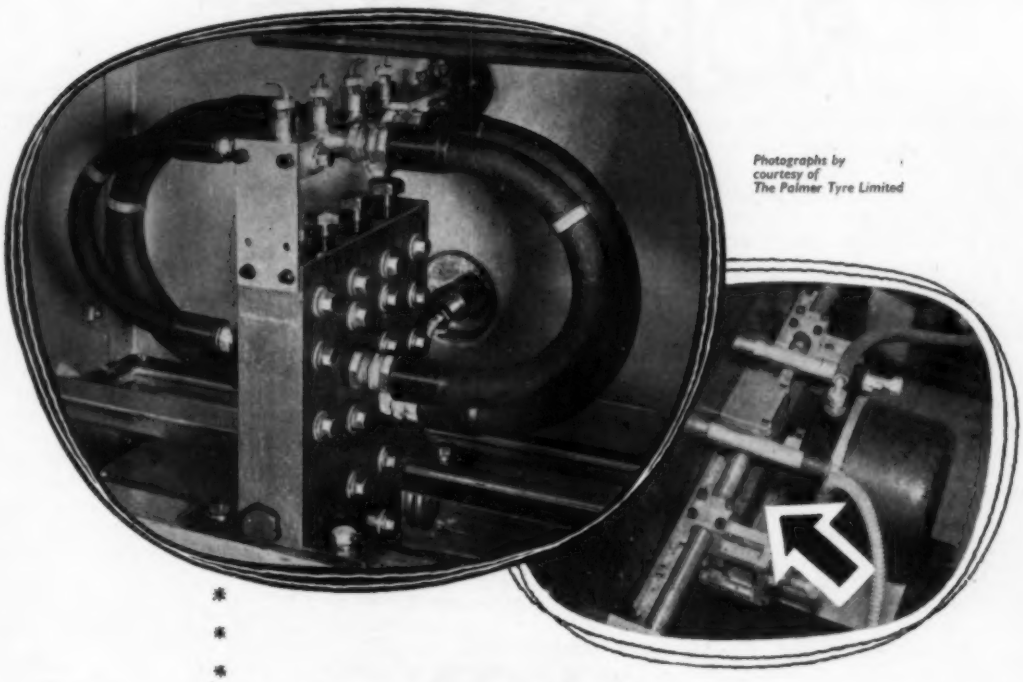

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2487 Vol 70 FRIDAY 21 SEPTEMBER 1956

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Hustler—

IN our Military Aircraft number earlier this year we remarked on the scarcity of new bombers. This, we suggested, had been brought about by extreme costs of development and operation, and because certain of the bomber's traditional missions could now be flown more economically, and with higher hopes of success, by adapted fighters. A fighter such as America's McDonnell Voodoo, having an already respectable "built-in" range and possessing flight-refuelling, supersonic and nuclear capability, could clearly present some stiff defensive problems, for its run-in and over-target speeds could be high in the supersonic regime. Implicit in that term "over-target," however, is one deficiency which, under conditions now pertaining, could place it at a severe disadvantage as compared with the "conventional" multi-engined, multi-seat bomber.

By virtue of the guided bombs which form its armament (the Bell Rascal, of 100 miles range, is the best-known example), the specialized bomber of to-day has no need to penetrate the target area at all; consequently, it is less vulnerable to the enemy's inner defences and to the heat and blast effect of its own weapons. In point of accuracy, moreover, its guided bombs should prove superior to the free-falling or parachute-lowered weapons as are likely to be launched by the converted fighter.

It is the necessity for carrying large guided bombs, and for using the newest and most elaborate navigational aids to ensure delivery over ranges unattainable even by the largest fighters, which is perpetuating the classic bomber line. The latest addition to that line is Convair's B-58 Hustler, subject of a critical appraisal in this issue.

Although, as the Technical Editor recounts, the Hustler specification originally called for a Mach number of 1.7 to 1.8, the bomber as now in being may well prove appreciably faster. More than once in recent weeks we have heard a Mach number of 2 suggested, though we have yet to receive a dependable explanation of the intended range/cruise technique. For what length of time and in what circumstances the Hustler is intended to fly supersonically remains a riddle, though when operating at full thrust and at optimum height it should clearly outstrip most present-day fighters. Altitude performance should prove exceptional and, the possibilities of load-stowage being many and varied, it is hardly remarkable that a fighter version should now be envisaged. This, it has been suggested, should act as a mother-ship for pilotless intercepters; but though for the present the *modus operandi* remains obscure, the menace of the supersonic bomber, typified by the Hustler itself, is disconcertingly plain.

—and Gnat

A WEEK that brought disappointment and despondency (with yet another —and even lengthier—postponement of B.O.A.C. Britannia services) brought also a tonic piece of news for which the nation at large has waited restlessly for the past two years. A production order has been placed for the Folland Gnat. Not, it is true, for the sort of quantity that was widely hoped for, but nevertheless for a £3 million batch of 25, and with a licence agreement attached. And this, says Folland's "Teddy" Petter with quiet confidence, is only the beginning.

To Petter, for his vision and tenacity; to Folland Aircraft, for an excellent piece of business; to Bristol Aero-Engines, upon this latest acknowledgement of the Orpheus—a turbojet beyond compare in its class—the congratulations of the entire industry will go out. And to the Ministry of Supply, for its helpful, if small and belated, contribution of an order for six examples, a measure of thanks.

We now look for other nations—perhaps three or four—to follow India's lead; and although interest in the carrier-borne Sea Gnat project appears to have flagged, there is new promise in the Gnat Trainer, detail design of which is already in hand as a "P.V." by the ever-venturesome ones at Hamble.

SIGNING AND ASSESSING: Seen on the occasion of the signing of the contract for Folland Gnats (see this page) are: (l to r) Mrs. Pandit, High Commissioner for India, Mr. W. E. W. Petter, managing director and chief engineer of Folland Aircraft, Ltd.; and Sir Reginald Verdon Smith, chairman of the Bristol Aeroplane Co., Ltd. On the right is S/L. Suranjan Das, Indian Air Force, familiarizing himself with the first of the M.o.S. Gnats. Son of the Chief Justice of India, S/L. Das is a graduate of the Empire Test Pilots' School and has flown the Hunter, Vautour and Mystère.

FROM ALL QUARTERS

India's Gnats

THE Indian Government, through its High Commissioner in London, Mrs. V. L. Pandit, on September 15 signed agreements with Folland Aircraft, Ltd., and Bristol Aero-Engines, Ltd. The former is for the purchase of 25 Gnats and for the manufacture of Gnats under licence in India at the Bangalore works of Hindustan Aircraft, Ltd. The latter is for "comprehensive technical assistance" in the manufacture of aircraft gas turbines in India. It includes authority to manufacture under licence the full range of Orpheus turbojets (engines of this type will power both the British and Indian-built Gnats), including the BOr.2 or 4,520 lb thrust and the BOr.3 or 4,850 lb thrust (more powerful versions are under development).

The first of the British-built Gnats is due to be delivered next April; and to facilitate the start of Indian production the Folland company is to supply a number of component and detail parts, and to train Indian technicians, both at Hamble and in India. The total value of the contract is £3m, and the agreement runs for ten years.

Bristol Aero-Engines, Ltd., are to send engineers to India to assist in the establishment of a gas-turbine manufacturing unit there (probably near Bangalore), and will train Indian technicians in Britain.

English Electric Flying Appointments

THERE have been three additions recently to the flying staff of the English Electric Co., Ltd., Mr. J. W. Hackett and Mr. K. Isherwood joining as test pilots and Mr. P. J. Moneypenny as administrative assistant to Mr. R. P. Beamont, the company's manager of flight operations and chief test pilot.

Mr. Hackett and Mr. Moneypenny—formerly a captain and navigator, respectively, with Silver City Airways—set up three world records in an English Electric Canberra in August 1955 by flying from London to New York and back in 14 hr 22 min. Their speed on the outward journey was 461 m.p.h., on the return 550 m.p.h., and their average for the whole flight—including half an hour on the ground in New York—481 m.p.h.

Mr. Hackett is an ex-R.A.F. pilot who flew with Coastal Command during the war and has since—apart from his airline flying—delivered many types of aircraft to countries all over the world. He will be doing test-flying for English Electric. Mr. Moneypenny is a former R.A.F. navigator and Mr. Isherwood, who is to do production test-flying and also fly the company's communications aircraft, is a former R.A.F. fighter pilot.

Rouble Trouble

ACCORDING to our Indian correspondent, the supply of Ilyushin aircraft offered to India by Russia has been seriously set back by the difficulties that Indian aviation experts have experienced in comprehending the Russian technique of costing, which "appears to be completely different to that of other countries." In an effort to form a reliable opinion of the cost of running the aircraft India has asked Russia to send a few Il-12s for trial, but this suggestion has received no response; nor have Soviet authorities been able to give the information required for estimating the cost of maintaining and overhauling the aircraft. India recognizes that a long period of service experience would be required for the necessary data to be collected and her caution is also prompted by the realization that, whereas aircraft from Western markets are easy to resell, "this cannot be said of Ilyushin aircraft."

Douglas X-3 Retires

AFTER carrying out many research flights for the U.S.A.F. and N.A.C.A., the Douglas X-3 turbojet-powered research aircraft—which first flew in October 1952—has been returned to the U.S.A.F. for disposal. Carrying 1,200 lb of instrumentation, the aircraft was engaged in transonic and supersonic flight tests, information gained being used for U.S. Navy and Air Force supersonic fighters. Its structure included much titanium.

Air Marshal Bishop

ON September 11, at Palm Beach, Florida, Air Marshal William Avery Bishop, V.C., C.B., D.S.O. and Bar, M.C., D.F.C.—to mention only his British decorations—died in his sleep at the age of 62.

This peaceful ending for the almost legendary "Billy" Bishop, perhaps the most famous of all R.F.C. fighter pilots, was in keeping with his apparently charmed life; for though on his first sortie he only just managed to glide back over the British lines when his engine failed, and though involved in innumerable air combats (he destroyed 72 enemy aircraft, excluding "probables") Bishop survived the war with no worse injury than a damaged knee caused by a rough landing when he was flying as an observer.

Between April and August, 1917, he won not only the V.C.—for a lone dawn attack on an airfield twelve miles inside enemy lines, when he destroyed or damaged four machines—but also the D.S.O. (twice) and the M.C. He received his V.C., D.S.O. and M.C. from King George V on the same day. During his second spell in France, in June 1918, when he commanded 85 Squadron, Bishop was awarded the D.F.C. for his phenomenal achievement of destroying 25 enemy aircraft in twelve days.

At the end of the war, still only 24, he was a lieutenant-colonel

Air Marshal Bishop—photographed in England in 1942.

and had received all the highest British and French awards for gallantry. He owed his success as a fighter pilot not only to his dauntless courage—most of his attacks were carried out well over enemy territory—but also to brilliant (and consistently practised) marksmanship. His former foes paid high tribute to him when in 1928 he was guest of honour at a gathering of German airmen in Berlin.

During the inter-war years, Bishop was concerned with commercial flying, both in Canada and in this country, and in 1929 became chairman of British Air Lines. After his return to Canada he became vice-president of the McColl Frontenac Oil Co. In January, 1936, he was appointed the first Canadian air vice-marshal. He was promoted air marshal in 1939; and during the war, as Director of Recruiting for the R.C.A.F., had much to do with the Empire Air Training Scheme.

Prototype Specialist's New Post

S. F. Perry.

WELL known in the industry for many years, Mr. S. F. Perry, M.B.E., has joined F. G. Miles, Ltd., as general works manager of their Shoreham organization. On leaving the R.A.F. in 1925 Frank Perry joined the design staff of S. E. Saunders, Ltd. (later to become Saunders-Roe). He later went to Supermarine Aviation Works, Ltd., with whom he remained until 1928, when he entered the design office of Simmonds Aircraft — subsequently associated with Saunders-Roe—ultimately becoming their assistant chief draughtsman. In 1928 he resumed his association with Supermarine. In 1938 he was appointed their assistant works manager and in 1940 he became experimental manager. He was responsible for the manufacture of all the company's prototypes from 1940 until today, the last in this progression being the N.113.

A. M. Low

THE death occurred at his Chiswick home on September 13 of Mr. A. M. Low, M.I.M.E., F.C.S., F.R.G.S.—widely known as Professor A. M. Low, the popular scientific writer—at the age of 68. Though he never held a university chair (he was honorary assistant professor at the Royal Artillery College from 1919 to 1922), he was regarded by a wide public as being worthy of the title of professor; and certainly he looked the part.

He was responsible for the building and launching (at Upavon in 1916) of "the first guided missile," and contributed an amusing reminiscent article about it to *Flight* for October 3, 1952. He developed several of these pilotless aircraft—miniature biplanes and monoplanes of fairly orthodox design, usually launched from rails by means of compressed air. The experiments were not entirely successful, and the work was abandoned; but in later years Low took particular pride in reiterating that Britain had developed the first guided missile.

After those early days he was little concerned with aviation, though from time to time he was identified with the study of aircraft noise; the silencing of mechanically propelled vehicles was one of his favourite hobby-horses.

As president of the Institute of Patentees and Inventors he did a good deal to encourage struggling inventors; and he was constantly in demand by motor clubs and kindred organizations for after-dinner speaking, an art in which he had few equals. He was a man of exceptional wit and charm, and his passing will be lamented by a wide circle of friends.

Skylarks

PREPARATIONS are now being completed for the International Geophysical Year, which begins next July, and will represent the greatest scientific research project ever organized on a world-wide basis. At Barcelona recently, a "working group" making arrangements for the 18-month programme decided among other plans that Britain's high altitude rockets, designed to penetrate the upper atmosphere, should be designated "Skylarks."

One of these rockets—which have been developed by the Royal Aircraft Establishment at Farnborough and which will carry scientific equipment 100 miles into outer space—will possibly be test-fired from the Ministry of Supply experimental range at Aberporth before the end of this year. At least ten Skylarks are to be fired for research purposes.

Meanwhile, in the United States, flight tests of one of the rockets developed for the earth satellite programme are due to be started this autumn, according to the main contractors for the project, the Martin company, of Baltimore. The one-stage rocket, known as the Viking, has already been tested up to heights of more than 150 miles. The new tests will more than double that height by the addition of a third-stage rocket.

WAGER EARNERS: Flanking Mr. Harold Best-Devereux, pilot of the Auster J.4, are Lord Essendon (left) and Lord Selsdon, drivers of the Triumph T.R.3 in the contest for a Royal Aero Club £50 wager that an aircraft travelling from Land's End to London via John O'Groats would use less petrol than a car. The Triumph left St. Just airfield on schedule, a minute after midnight last Saturday morning, and reached Elstree—destination for both competitors—in the early hours of Tuesday, after a 1,600-mile journey. But the Auster was fogbound and could not take off for Rearsby (its first stop) until 0952 on Tuesday.

Javelin Production

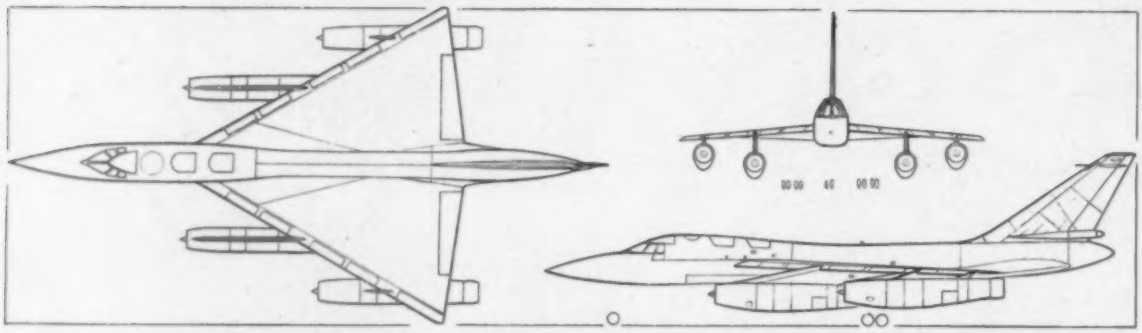
AT a routine mass meeting of workers at the Brockworth factory of the Gloster Aircraft Company on Monday, Mr. W. R. Green, district secretary of the Amalgamated Engineering Union, said that unless further orders were forthcoming, about 1,500 workers engaged on Javelin production would be dismissed after Christmas. Semi-skilled fitters and machinists would be the first to go. Reasons put forward by Mr. Green were a slowing-down of Javelin production, lack of orders from abroad and cancellation of the contract for a supersonic development of the Javelin. The Gloster Aircraft Company had, at the time of going to press, no comment to make except that present R.A.F. orders would still take some time to complete.

Bitteswell Recruit

RECENTLY appointed a test pilot at the Armstrong Siddeley engine flight development unit at Bitteswell, near Rugby, is James ("Harry") Pollitt. He joined the R.A.F. at 17 and became the youngest pilot ever to be accepted for a Central Flying School Course; a year later he became the youngest staff instructor at the C.F.S. itself. Now, at 22, he joins Armstrong Siddeley with experience covering many different types of aircraft.

The various test-bed and research aircraft now at Bitteswell include Hunters, Javelins, Gannets, Canberras and Lancasters; there is also a Jet Provost, a Seamew and a Mamba-powered Dakota.

Mr. J. Pollitt, Armstrong Siddeley's new test pilot.



THOUGHTS ON THE HUSTLER

First Allied Supersonic Bomber—and the First True Weapons System

By THE TECHNICAL EDITOR

I ONCE met a Texan who stood a bare five feet in his socks—but he was merely the exception which proves the rule. In general the inhabitants of the Lone Star State are massive in stature; and their accomplishments are—so they tell us—on a correspondingly grandiose scale. Not the least of their achievements is the manufacture of nearly 400 enormous B-36 bombers at the Convair plant at Fort Worth. There is no doubt that the existence of these awe-inspiring aeroplanes has been a major factor in the Strategic Air Command's global policy of "massive retaliation."

Today one of the U.S.A.F.'s leading problems is whether or not the B-36 is still a sufficiently effective delivery system to enable it to function as a "great deterrent." One is increasingly driven to the conclusion that it is not, and even to the contention that its sleeker, jet-propelled successors by Boeing might prove uncomfortably vulnerable to the latest fighter and missile systems. This is unpalatable, for several billion dollars are locked up in these machines. Yet facts cannot be ignored and the U.S.A.F. were not slow to draw up basic requirements for a supersonic bomber (design limit, Mach 1.7-1.8) capable of placing paralysing blows on even the most heavily defended target. The first discussions on such a project date from the late 1940s but the Air Force did not really crystallize its ideas until about 1952.

In that year two great machines contended for the honour of selection as the standard long-range bomber for Strategic Air Command. These were the Boeing B-52 and the Convair B-60, the first entirely new and the other a redesigned B-36 which might have been available rather sooner. In the event the Air Force chose the Boeing and it was therefore not surprising when Convair received the design contract for the supersonic machine, designated B-58. Doubtless the requirement was put out to tender but it is unlikely that any other firm could really have spared the engineering effort necessary to produce such a design. It is also relevant to remember that at this time the Air Force had also to decide who was to build its future jet tanker, and this also was put out to tender even after a preliminary contract had been placed with Boeing at Renton.

Convair are a division of the General Dynamics Corporation, with divisional headquarters at San Diego. The Fort Worth plant has a floor area of almost 4½ million square feet and a payroll of roughly 21,000. The last of the B-36s went out of the door there more than two years ago, and the works have since suffered what Americans term a "bathtub," i.e. a period of inactivity between the completion of one production programme and the start of its successor. This bathtub has been partially filled by major modification programmes to B-36s and other aircraft.

On the engineering side, however, there has been intense effort ever since the B-58, or "Hustler" (the name has now been officially adopted), went to Convair. The work-load on the company was greatly increased by the fact that the whole Hustler programme is the first true "weapons system," as the U.S. industry understands the term. Briefly the idea is that each weapon shall be a complete system in which every single related part shall be designed in harmony with its neighbours. Thus, for example, the B-58 airframe, engines, accessories, ground equipment, training aids and even the technical manuals are *all* the responsibility of the "prime contractor"—Convair.

In the past the "prime" has seldom been responsible for much more than the design of the airframe. Engines and accessories have often been dictated in advance, and all contracts connected with their purchase, and with sub-contract of structural parts, have been placed by, or on behalf of, the customer (the Air Force). Under the weapons system concept the Air Force undertake to buy a weapons system called the B-58 from one supplier, Convair. This manufacturer decides who shall build which parts, places all the orders, works closely with each of the hundreds of equipment manufacturers which he has chosen, and so integrates the whole system that—in theory—it comes out at the other end as a going concern. Government-furnished equipment (G.F.E.) is held to an absolute minimum.

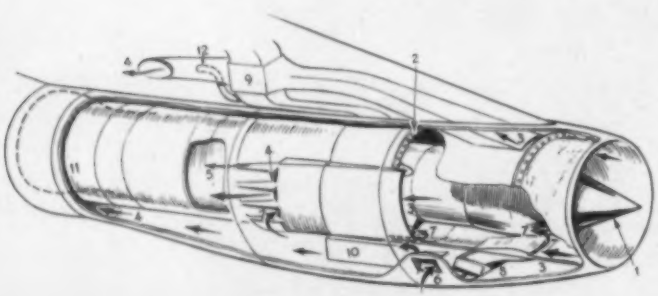
Advantages of such an arrangement are self-evident. The drawbacks are few, but the autocratic position of the "prime" could certainly render the arrangement open to abuse. In fact several sub-contractors have become worried that, in time of recession in particular, they might find themselves without any business (as happened to certain British sub-contract companies in 1954). To safeguard themselves they formed the Small Defense Industries Association, which is at present hoping that the threat will never be more than a potential one.

With the B-58 everything seems to have gone smoothly, and several hundred small firms have been brought into the programme. From early on the engine supplier has been General Electric, whose J79 is ideal for this application. In a supersonic bomber the volume of engines plus fuel is critical and the J79's high pressure ratio, small bulk and low weight form an attractive combination. Initially the B-58 was intended to have four afterburning J79s in twin pods mounted conventionally under the wing, but ground-running tests with J47s and with an afterburning J57 indicated that, particularly on the ground, this disposition would raise the temperature of the underside of the wide-chord wing to an unacceptable level. The next arrangement was to have the four engines podded above and below the wing, but area rule (*Flight*, September 30, 1955) dictated a different layout.

Probably more than any other firm Convair are area-rule conscious. Through it they managed to make the F-102 interceptor supersonic and their neglect of it held up the performance development of this machine for more than a year. Tunnel tests of B-58 models indicated that the bomber was also likely to

Convair had a big hand in developing both the J79 and the B-58 nacelle. There are three ram-air coolers, fed by side doors at under Mach 0.6 and by secondary intakes at higher speeds. Details shown include:—

1, Sliding nose-cone; 2, engine intake; 3, secondary cooling intakes; 4, cooling-air outlets; 5, flow through inner cowling; 6, low-speed intake door; 7, reverse cooling flows at low air speeds; 8, oil cooler; 9, cabin-air heat exchanger; 10, accessory group; 11, con-di afterburner nozzle; 12, compressor-bleed ejector pump.



Ram Jet development

Five years of Napier research and development —in conjunction with the National Gas Turbine Establishment—have resulted in a successful free-flight ram jet test vehicle which has recently reached record altitudes at supersonic speeds. This test vehicle is launched and carried to supersonic speed by a cluster of rocket boost motors, which separate and fall clear, leaving the ram jet to accelerate away under its own power. Napier engineers are now engaged on the design and development of ram jet engines for aircraft propulsion. This, together with intensive work on rocket engines, will ensure Napier leadership as manufacturers of propulsion units for the high speed aircraft of the future.

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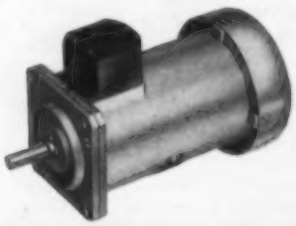

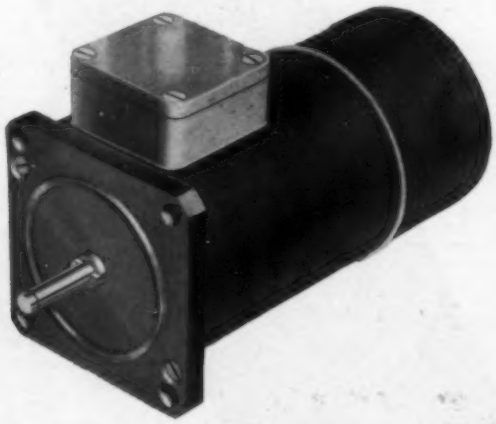

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THOUGHTS ON THE HUSTLER . . .

suffer fearsome drag rise in the transonic region, and a reduction in the estimated ultimate performance caused the U.S.A.F. to cut the initial order for the type from 30 to 13 aircraft. Application of the rule more than restored the lost speed and, as a diagram shows, has been done in a most happy manner.

In the final configuration the four powerplant nacelles are so disposed that they exactly fill in the area diagram to give minimum transonic drag. The fuselage also has a variable cross-section, which makes allowance for the external stores associated with some of the weapons-systems with which the B-58 is identified.

Undoubtedly the most noteworthy part of the aircraft is its powerplant system. The basic J79 is a single-spool, variable-stator engine rated at about 11,000 lb thrust (16,000 lb with afterburner). In conformity with the integrated design philosophy the overall thermodynamics of the four engines have been treated as a single factor, in conjunction with the aerodynamics and thermodynamics of the airframe. The problem of heating the wing under-skin during ground running has already been mentioned; in flight there was no such problem, although the nacelle incidence for maximum inlet recovery during high-altitude subsonic cruise conditions (i.e., at a high angle of attack) aggravated the heating and demanded a compromise. In the event the inner engines are mounted at a marked positive angle and the outers at a negative angle (their propelling nozzles being clear of the trailing edge).

A schematic diagram (p. 508) outlines the arrangement of airflow within each nacelle. Air is used for all cooling functions, even that required by the engine-oil system. All the air is taken in through the main circular intake, which is a variable-geometry assembly with a central spike positioned by a Minneapolis-Honeywell system which also opens and shuts diffuser-bay bleed doors to position the second (normal) shock inside the intake. The Hustler intake has been extensively tested under all conditions and is likely to be standardized on other types of aircraft.

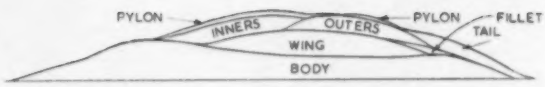
The main flow is divided up into a supply to the engine (about 89 per cent of the total) and secondary cooling flows for the engine, accessories, oil and hydraulic fluid and cabin air. All the basic engine and airframe accessories are mounted directly on drive pads under the J79. As far as possible each accessory is in the drag shadow of the first so that they form a row of minimum frontal area. Cabin air is bled, at very high temperature (certainly over 750 deg F under some conditions), from the J79 compressor and cooled by one of the ram-air flows, the latter being boosted by a bleed-air ejector pump as shown in the diagram. In a high-pressure turbojet at Mach 2 the temperature at the delivery from the compressor is almost as high as that reached at the hot end of the engine. This is one of the factors which led Convair and G.E. to dispense with all nacelle firewalls and use instead a veritable hurricane of cooling air between the engine and cowling. Not only does this form a cooling blanket but it isolates the engine from the pylon strut, which also has a firewall at its lower end and a fire curtain where it joins the wing. The strut itself is fully ventilated.

Airframe Design

Most of the Hustler airframe has probably been a fairly straightforward, plodding job, but the design of the wing has undoubtedly caused several major headaches. Thickness/chord ratio is of the order of four per cent and virtually the whole primary structure forms an integral fuel tank. The aerodynamics of the wing are essentially similar to those of the much smaller F-102, except that fences are, Convair hope, not needed. A most interesting, but classified, system of construction has been evolved which reduces heat transfer. About 15 per cent of the superficial area of the Hustler is skinned in stainless steel, including the rear of the nacelles, the pylons, and much of the wing undersurface and ailerons. Stainless honeycomb has been found to stand up well both to high surface temperature and to intense high-frequency vibration from the engines.

A problem which is becoming increasingly acute in the design of fast aircraft with integral-tank wings is that, owing to the high ratio of surface area to volume, the fuel temperature is very quickly raised or lowered by variation in skin temperature—which is, in turn, critically dependent on solar radiation and kinetic heating. For the Hustler new techniques have been evolved to minimize wing temperature. These involve keeping the aircraft in the shade before take off; climbing quickly to cold atmosphere; minimizing supersonic flying; use of a special finish to reflect more solar radiation (so that the Hustler may have a white top as well as a white bottom); and, in hot ambient conditions, use of insulating blankets and ground refrigeration. Clearly there has also been a lot of work on the problems of temperature-resistant auxiliary services, hydraulic fluids and on cabin conditioning.

It is likely that the B-58 programme has required the development of more completely new accessory equipment than has any other aircraft. All this new paraphernalia has become "hardware" in advance of the aircraft itself, and Convair have logged many thousands of hours from Carswell A.F.B.—next to the Fort Worth plant—in testing it under extreme environmental conditions. The work began some 20 months ago with a specially prepared B-36, and has since required the services of another B-36, together with a B-47, an F-86, an F-89 and three C-131B avionic (aviation electronic) test beds. Avionics are a major item in the B-58; Convair once estimated that, of every dollar spent on the programme, Convair received 38 cents and the avionics firms 45 cents.



This sketch indicates how the various parts of the basic B-58 fill in the area diagram to give minimum drag (a Sears-Haack profile). The "mission pod" is not allowed for.

In most missions the B-58A production machine—if it is built—will be a bare carrier vehicle which will not become a weapon until something has been added to fit it for a particular function. Normally this "something" will be a pod attached under the fuselage over which the aircraft will be towed; and the size and expected growth of such pods accounts, in part, for the considerable clearance between the Hustler fuselage and the ground. One pod will contain nuclear weapons; another will contain cameras; another will contain various types of missile. The intercepter B-58 will act as mother ship to pilotless intercepters, named Duck and Goose; the Fairchild Blue Goose, already tested, is the "long-range" portion of this system. The RB-58 will have a camera pod full of closed-circuit TV to act as the viewfinder and to govern the automatic control system of the cameras for pulse and image-motion control. The Fairchild Camera and Instrument Corporation recently announced that they had cut the weight of this system from 1,584 to 295 lb, no doubt by transistorization. Yet another system involves an airborne countermeasures pod, developed by the Waltham Laboratories, which will be standard on four out of the first 13 machines. There are even tanker and transport Hustlers on the drawing boards.

Advance Prospects

Of the basic geometry of the B-58 little need be said, since it is evident from the three-view drawing and from the photograph published last week. It is very largely a case of scaling-up the F-102, and, incidentally, making a better and more thoroughbred aeroplane. Reflection shows that it was inevitable that, short of taking off from a trolley, the B-58 should have a multi-wheel bogie undercarriage—very similar to those of the Victor and Vulcan.

The first of the 13 at present being built is currently about to start taxying trials and could be in the air by October. Convair have a big stake in this aeroplane, for not only are they entirely responsible for every bit of it but their Fort Worth plant's future depends on it. For years past many eminent Americans have been by no means "sold" on the idea of a supersonic bomber. Among them can be counted a fair proportion of the generals of Strategic Air Command; and a story is told that even the terrifying LeMay himself once walked out of the B-58 mock-up declaiming "I don't buy it—it doesn't fit my figure," or words to that effect. A cramped cockpit is, of course, difficult to avoid in such a machine.

Now, however, the tide may be turning for Convair. Research and development funds are becoming harder to obtain, and the new supersonic bomber designs, originally intended as B-58 replacements, may be held up in consequence. In fact it is arguable that the visit of Tactical Air Command to the B-58 team last February is a portent of increased orders and wider applications for this noteworthy machine. Nevertheless Convair are not going to have things all their own way; and, in particular, the complete dependence of the B-58 upon flight refuelling for strategic operations is making it difficult for it to win over the recalcitrant S.A.C. generals.

More and more is S.A.C. looking to even more advanced machines. Lockheed are teamed with Pratt and Whitney in the development of a nuclear bomber and Convair are themselves working with G.E.—all on U.S.A.F. study contracts. Tangible hardware for these aircraft is already in existence and so it is for the Boeing Weapons System 110, a Mach 2 bomber running on ethyl borane fuel and with a brochure performance likely to put all other bombers out of business (and this does not except the score of range). One can only wait and see what the U.S.A.F. decides to buy, and they have announced that they will not ask for funds for B-58 production until the fiscal year 1958.

GLIDING CAMP: Each year, a party of cadets from the Royal Naval College, Dartmouth, spends ten days at an R.N. air station, where they receive gliding instruction. This year they have been at Bramcote, Warwickshire, where these photographs were taken. On the left, pupils round a Prefect are briefed by Instructor Commissioned Airman B. Gunter (in flying suit); in the second picture, a T.31 two-seater is flown by a trainee above a typical suburban-rural Midland landscape.

HERE AND THERE

Ouest-Aviation

THE French nationalized aircraft company formerly known as S.N.C.A.S.O. has, from September 1, taken the name Ouest-Aviation, Société Nationale de Constructions Aéronautiques. Its head office address is unchanged at 105, Avenue Raymond Poincaré, Paris 16E. [On August 28 the S.N.C.A.S.E. company changed its name to Sud-Est Aviation.]

Ellehammer Commemoration

ON September 12 a replica of the aircraft built by the Danish pioneer J. C. H. Ellehammer in 1909 took off from the island of Lindholm. Constructed and piloted by Mr. Sylvest Jensen, it flew 20 miles across the sea to Vordingborg, where it landed half an hour later. The flight was in commemoration of Ellehammer's first powered "hop" of 137 feet on Lindholm, exactly fifty years previously. At Vordingborg, Mr. Jensen delivered 6,000 letters franked with a special Ellehammer stamp issued by the Danish post office.

Brigadyr in Production

CZECHOSLOVAKIA'S Avia L-60 Brigadyr utility and agricultural aircraft (see *Flight*, September 9, 1955) is now in production—with a Praga Doris B engine of 220 h.p.—at the Orlican State Aircraft Factory. Two examples are being shipped to South America, where "substantial sales" are expected.

The Rains Never Came

SUCCESSFUL rain-making experiments have been "going on for years" in the U.S.S.R., according to Soviet radio reports. On August 8 an aircraft equipped for spraying dry ice converted a cloud at 12,000ft into rain. Four years ago, on November 7, 1952, anniversary of the Bolshevik Revolution, this technique was apparently put to patriotic use; for "our glorious pilots" intercepted and broke up the clouds, spraying them with ice and turning them into rain, before they could reach Moscow and spoil the military parade.

COMMON INTEREST exemplified by Russian visitors and English hosts during the recent visit of the Soviet Minister of Aircraft Production, Mr. Dementiev, to the Viscount production line at Hurn. In this group are, left to right, Mr. H. E. Handcocke, M.o.S.; Mr. George Edwards, Vickers-Armstrongs (Aircraft) managing director; Mr. Dementiev; one of his aides; A. Cdre. H. D. McGregor, M.o.S.; Mr. W. Comber, Hurn production manager; and Mr. H. Henderson, V-A. customer relations.

For Maximized Salary?

FROM a Radio Corporation of America advertisement for staff: ". . . integration of theory, equipments and environment to create and optimize major electronic concepts."

Flying Cranes

THE Research and Development Command of the U.S. Army Transportation Corps is reported to have awarded a contract to the Piasecki Aircraft Corporation for evolving advanced designs of "flying crane" helicopters.

R.Ae.S. Awards

THE council of the Royal Aeronautical Society has announced awards to the following: G. E. Cook (*R.Ae.S. Charter Scholarship*); R. W. Roberts (*Busk Studentship in Aeronautics*); D. M. Squires (*Geoffrey de Havilland Memorial Scholarship*). Grants for further study have been awarded to: M. G. Bader, J. T. Black, E. M. Coburn, J. I. Dodds, D. J. Huggett and N. E. Phelps.

Dressing Up

ANNUAL statistics for aerial top-dressing in New Zealand show a doubling of hours flown per aircraft, acres sown and tons of fertilizer distributed on each flight, since 1950. In the twelve months ending March 1950, 142 hours were flown per aircraft, 22.8 acres sown and 2.34 tons of fertilizer distributed each flight. In the twelve months ending March, 1956, corresponding figures were 263 hours, 48.3 acres and 5.06 tons.

Skywriting Revival in U.K.?

A WELL-KNOWN German skywriting company, R.M. Overseas Luftfahrt Abteilung (associates of Overseas Aviation, Ltd.) have brought their AT-6 Harvard D-IGAL to Croydon for a series of skywriting demonstrations; they hope to extend their activities to this country. Arrangements are in the hands of Autair, Ltd., 75 Wigmore Street, London, W.1, and Overseas Aviation, Ltd., 26 Hill Street, St. Helier, Jersey.

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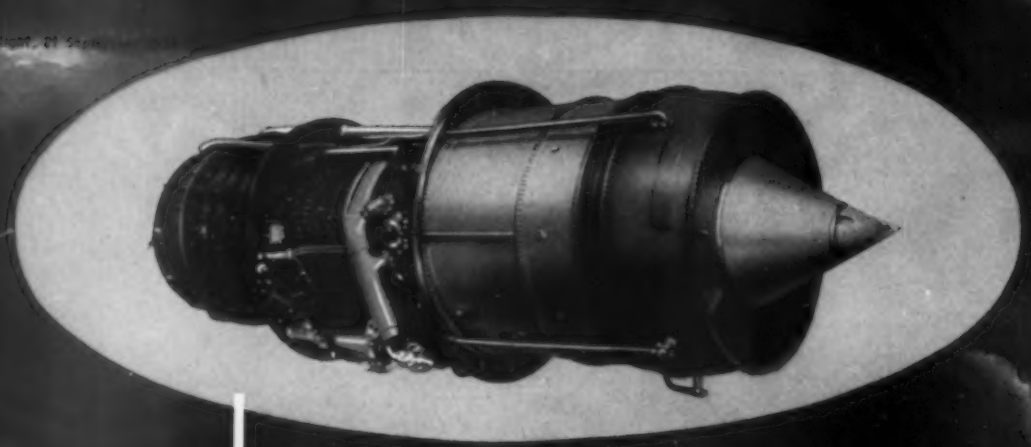

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New Developments in Radio and Radar

A User's Commentary on Ground and Airborne Equipment at Farnborough

At this year's S.B.A.C. Show the Marconi company relayed displays, by a new microwave link, from their S.232 radar at London Airport. The mobile link receiver is seen here on site at Farnborough.

THE radio industry always produces its crop of interesting exhibits at the S.B.A.C. show and this year ran true to form. In fact it is clear that the radio side of the aeronautical industry is as conscious of the early September deadline as is the aircraft manufacturer himself. Farnborough has no rival anywhere as a unique assembly point for anyone connected with the air transport business and the ground services needed to support it throughout the world. So, for the airline operators and those who have responsibilities for the provision and operation of air and ground radio services, the array of equipments for all aviation radio purposes was as complete as it could possibly be.

Some of the more important advances were to be found amongst the ground scanning radars and there was much evidence that the art has moved a long way from the "raw radar" stage. Generally speaking, ground radars made rather slow progress in their adoption as important surveillance tools of the controllers in the busy air-traffic complexes. This was partly due to the view widely held for a number of years that all that was needed was a highly precise radio navigation system and its attendant communications. Over the years this outlook has undergone a good deal of change; the navigation system and its associated communications are still a "must," but the third principal partner in areas of high traffic density is ground radar.

At least part of the trouble has been that the raw radar gave too much of the kind of information the ground operator did not want as an inescapable accompaniment to the information he did want. His interpretation of what is basically a very simple presentation was very seriously marred by the clutter of the permanent echo pattern and returns, in greater or lesser degree, from areas of precipitation. Both features of the radar technique can, of course, be made use of in particular applications such as the A.S.M.I or the cloud-mapping radar, but in the surveillance radar for air control purposes they confront the operator with so much redundant information. Further, the operation of a ground radar can be much simplified if the facility exists to transfer to the display certain other information external to the radar path, and also to extract information from it of a quantitative kind about the movement of aircraft in relation to each other and to fixed points in the control pattern. The radars demonstrated at Farnborough this year showed very considerable developments along these lines.

Four manufacturers showed substantial developments in ground radars for specific applications in air traffic control and some account of these will show the progress which has been made.

A.C. Cossor exhibited their new airfield control radar, a surveillance equipment which is designated "Cossor Radar Type 21" and operates at 10 cm wavelength with 500 kW peak power and a 1 microsecond pulse. It is derived from the A.C.R.6, to which it has a generally similar performance and coverage diagram. It was presented as a twin-channel equipment in mobile form with two table-top type displays in the vehicle itself, and a third remoted for external demonstration.

The major noteworthy features of the C.R.21 are the moving target-indicator system and the anti-rain quarter-wave plate arrangements. The M.T.I. unit uses the established coho-stalo technique. In the demonstration the utility and stability of this feature were evident. The sub-clutter visibility of this particular equipment was said to be of the order of 23 dB, which in operational terms appears to mean that the permanent echoes can be effectively eliminated without noticeable loss of performance or coverage on aircraft.

The quarter-wave plate used in this equipment has been mounted externally to the horn feed on the scanner and its position is remotely controlled so that the rain clouds may be either seen or eliminated at the discretion of the radar operator. A discrimination of some 20 dB in favour of the aircraft against rain is being achieved. Whatever it did to the flying, this Farnborough week played up to the radar exhibitors by providing an admirable opportunity to demonstrate the need for anti-rain provisions in search radar, and the demonstration was very effective.

The advantage of putting the quarter-wave plate outside the horn rather than in the waveguide assembly is understood to be that the design tolerances within the radar plumbing itself are thereby rendered less critical; and that the whole arrangement can be manufactured more cheaply.

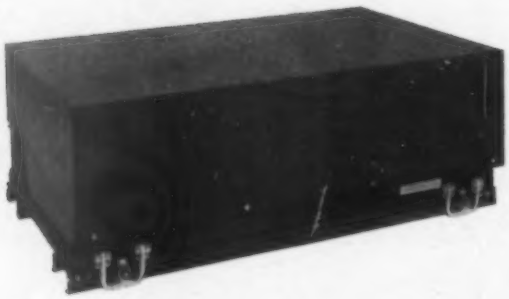
Cossor were also showing a K-band demonstration model of the anti-rain technique. This used a simulated cloud consisting of a large number of ¼in ball-bearings pushed into a block of expanded Polystyrene. The general view was that although it is not particularly surprising that this technique should work well against rain clouds, it is really extremely remarkable to demonstrate its effectiveness against a solid block of ball-bearings at such short range.

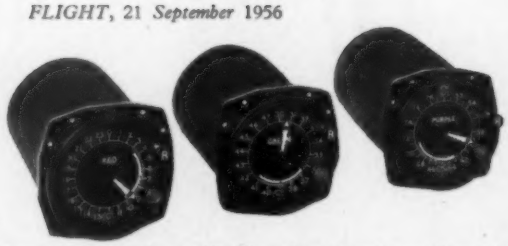
Amongst new developments on show by Decca Radar is a 3 cm glide-path radar designed as an operational companion unit to the Company's Type 424 plan-position-indicating approach radar. The new glide-path radar has a display adjacent to the Type 424 azimuth but is otherwise quite an independent equipment and can, therefore, be added to existing 424 radars whilst retaining freedom to be placed on the operationally most desirable site. It is understood that the Mk 1 version of the 424 radar is in use at over 60 airfields, and this year the Mk 2 made its appearance. The Mk 2 version incorporates "anti-rain" provisions in the form of a variable polarization control (i.e. circular, elliptical or linear) for the prevailing weather conditions and also a new antenna system to reduce permanent-echo clutter. The overall result is a substantial improvement in operational utility, and maintenance of service, in conditions of rain or snow, not previously possible. Altogether the marriage of the improved Type 424 radar and the new glide-path radar provides a complete and flexible final approach and local airfield control system.

A Decca exhibit of very great versatility was the application of their further developed "Interscan" fixed-coil P.P.I. display techniques to an M.R.75 radar. The M.R.75 is by now well known, but the operational value of this or other radars when applied with the "Interscan" facilities is very considerably enhanced. Basically, the use of the fixed coil P.P.I. technique permits the addition of information to the display separately and independently from the basic radar returns with a universality not possible with the conventional rotating coil P.P.I. display. The "Interscans," so called because they are introduced in the dead time between sweeps of the time-base can be of any desired geometric shape—lines, circles, triangles, etc.—and by their use targets may be tracked, speed measured, bearing and range relative to fixed points or to other targets accurately measured, and information transferred in positively identified form to associated radar positions. Altogether a very versatile and flexible tool for which the air traffic controllers will come to develop a wide variety of uses.

An addition to the range of meteorological radars is the new Decca wind-finding radar. The prototype was on show with its balloon-borne corner reflector. This is understood to be the first primary radar designed from the outset for wind-measurement purposes, a topic already of great and increasing interest and importance for jet operations. The radar is a 3 cm equipment using a large dish to give a one-degree beam, the beam itself being aditionally spun about the axis to describe a cone of one degree angle. The display is on a 9in I-scope on which the signal appears as a segment of a circle, the radius of which gives range and the length of which is governed by the aiming error, so that when the radar is on target the circle is complete.

A valuable feature of the design is the provision made for





The new Decca Navigator Mk 10 equipment, and new Decometers.

NEW DEVELOPMENTS IN RADIO AND RADAR . . .

the very accurate determination of the difference in range between two successive readings of range on the moving target. The accuracy of measuring range increment is said to be better than one per cent of a 10 km increment.

A simple and potentially very useful development in the secondary radar field is Decca's tiny airborne transponder, which they have christened "Aster." It is a transistorized box weighing only 36 oz and is used to detect the signal from the ground radar and return *via* the V.H.F. communication channel in use in the aeroplane. The radar thus is given a means of positively identifying a particular target since in normal use the Aster would be switched in by the pilot on request from the ground controller. The display is simple—when Aster is transmitting the radar echo becomes a short line at the position on the P.P.I. of the primary radar echo.

Since we reported on the Marconi company's 50 cm Type S.232 ground radar last year, the first production equipment has been installed at London Airport, where it is in use for the control of outbound traffic. For the purpose of demonstration during S.B.A.C. week, the display of the radar in use at London Airport was relayed by microwave link to Farnborough. It will be recalled that this radar, because it operates on a comparatively high wavelength, is crystal-controlled, which permits extremely effective cancellation of the permanent echo clutter. As seen in use, the relayed display included an additional feature, fed in by video-mapping techniques—the fixes and approach patterns of the A.T.C. complex in the London area. The link by which display was remoted operates on 4,000 Mc/s and gives a wide-band circuit for transmission of three radar pictures without degradation, a telephone channel and telemetering and switching channels. In this demonstration one channel was used for relaying a high-definition television picture. The fixed-coil displays giving inter-trace marking confer flexibility in the form of facilities for identifying an echo on one display to an operator on another display, laying-on another radar such as a height finder, indicating bearing and range of one aircraft relative to another and the tracking of aircraft echoes. Altogether a clean and impressive display of a cancelled radar in actual service, with the displays remoted by radio link over a considerable distance without loss of detail.

Another radar on show at Farnborough for the first time was the new Standard Telephones and Cables' precision approach radar, Type SLA.3, which is the company's successor to their well-known P.A.R. The new equipment gives the same facilities of elevation, azimuth and range relative to runway touch-down point; it is considerably simplified relative to the earlier version. The total number of valves has been reduced to a fifth with very substantial reductions in first cost and subsequent maintenance costs in comparison with the earlier P.A.R. The equipment has been designed for installation in either a permanent building, a prefabricated hut mounted on a turntable, or in a vehicle, and is remoted to the control point over a single cable. A new display unit using high-definition 17in C.R. tubes gives clearer presentation with higher reading accuracy.

Training of radar controllers both in civil and military applications can be a very costly business if it is done "live" on aircraft put up for the purpose. Both Mullard and Metropolitan Vickers were showing radar trainers, the former their SL.21 and the latter their type 556. The latter is a film type trainer using the video signal collected from a "live" radar stored on film and run through the trainer as required. The equipment, which has two P.P.I. "ranges," 120 and 240 n.m., will drive several display consoles for use in training schools. The Mullard SL.21 is primarily designed for G.C.I. training. It provides up to twelve artificial echoes which can be controlled as to speed, direction and rate of turn. These simulated aircraft radar echoes appear as outputs from the trainer and are fed into the P.P.I. display of an existing radar. The effects of winds up to 100 kt in any direction can be superimposed on the aircraft movements; maximum P.P.I. range provided is 240 miles, and outputs are available for up to six displays. It is understood that the Mullard and Metrovick trainers can be used together to provide whatever combination is desired of the different facilities offered separately by each.

There were new developments amongst the airborne radio exhibits on show and some are clearly going to be of high operational importance.

The first to come to notice were the models of airborne low frequency (95-130 Kc/s) teleprinter reception equipment on the stands of both Marconi and Standards. Both manufacturers use the new light-weight teleprinter machine developed by Creed, and each has produced a new receiver of specialized noise characteristics for the meteorological broadcast trials which have been under way in the North Atlantic for the past few months. It is understood that these trials, using transmissions at 60 w.p.m. from stations in Scotland and Canada, and carried out in B.O.A.C. and T.C.A. aircraft, have shown highly promising results; it can be predicted that before long the new system will be in operational service. Its uses could extend beyond reception in the air automatically of weather information, important as this is in lightening the flight-deck workload and relieving the congested high-frequency channels of a large part of their traffic.

About the second new system announced it is not yet possible for security reasons to say very much at the present time. Marconi were able to announce that they had for some time, under the sponsorship of the Ministry of Supply, been in production with an entirely self-contained airborne navigation radar system using the Döppler principle. The radar, with the type number AD.2000, basically determines to a very high order of accuracy the drift and ground speed of the aircraft. This basic information, together with heading reference, is fed into a computor which can be designed to yield navigational data in a variety of forms, e.g., latitude and longitude of present position, track guidance indications and distance run or to go, and so on. Details were naturally lacking from this partial-security release. Nevertheless, enough has been said to show that the Döppler principle has been successfully applied in a practical airborne equipment, and this news is of great significance for the future. It is naturally premature to speculate about what the AD.2000 will do to conventional ground-based aids, but there can be no doubt that on vast extents of the world's air routes a self-contained navigation aid could be of the greatest operational value, especially for fast, high-flying, long-haul aircraft.

On the subject of airborne radars, an entirely different type of radar, the E. K. Cole, Type E.120, which appeared for the first time last year, was again on show, but this year contained some improvements and additional facilities.

A new and very much lighter scanner weighing only 22 lb uses somewhat different stabilization methods from the earlier E.120 "front-end" but preserves the stabilization accuracy which distinguishes the E. K. Cole scanner from "line-of-sight" systems. Stabilization in bank has been increased to ± 45 deg and the azimuth scan has gone up from ± 75 deg to ± 90 deg. In addition, the new scanner provides for switchable beams—the conventional "pencil" beam for cloud detection and a cosec^2 beam for map-painting purposes. The change of beam shape is done by rotating the dish. The new radar also uses a simple application of the Döppler frequency-shift to provide for drift extraction, and the company are quoting an accuracy of the order of ± 1 deg. For drift measurement the scanner is stopped and servo-adjusted by the operator to point along the track the aircraft is following. An additional "A"-scope indicator unit tells the operator when this setting has been achieved and drift angle is read off as the difference between the scanner direction and the fore-and-aft line of the aeroplane.

These new features in the E.K. Cole nose radar considerably extend its operational uses as an airborne navigation aid, especially as they have beeen incorporated with small additional weight penalties offset to a great extent by the lightened scanner assembly. One further valuable feature of the new design is that the swept volume requirements of the scanner have now been cut down to the irreducible minimum for the 18in dish and 180 deg rotation. This greatly simplifies the installation problem in aircraft of slim nose configuration.

Impressive progress continues to be made with the Decca Navigator system, and since the Show last year there has been expansion of the area covered by the system coupled with official approval of its use for the navigational requirements of A.T.C.

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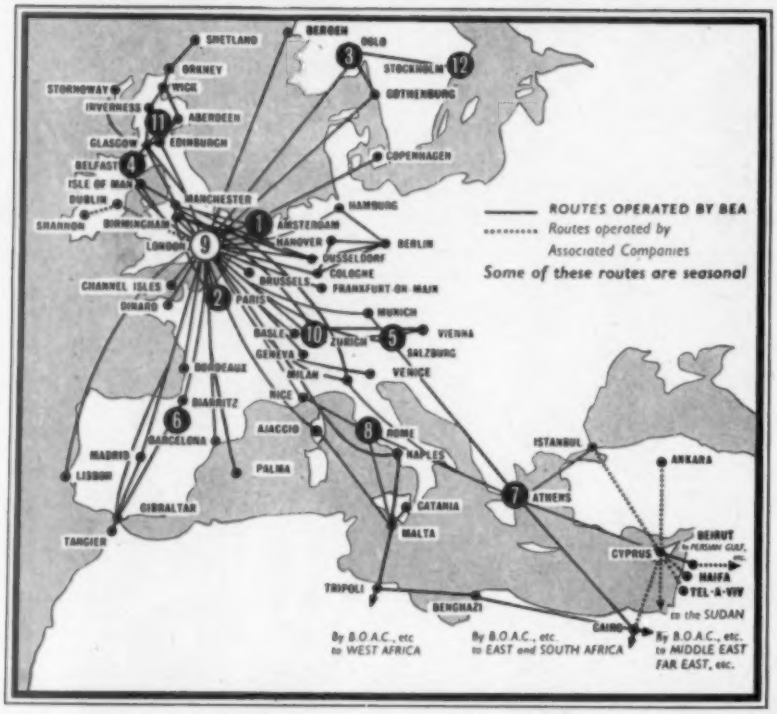

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BRITISH EUROPEAN AIRWAYS

NEW DEVELOPMENTS IN RADIO AND RADAR . . .

on the airways of the U.K. and its control zones. *Information Circular* No. 110/1955, followed by *Notam* 545/56, stated the M.T.C.A. policy attitude to the Decca Navigator System, and the company have backed this up by further development of the Flight Log and by completion of the development of their Mk 10 receiver, which now incorporates zone identification in addition to the automatic lane identification of its predecessors. Setting-up procedures are greatly simplified and the ambiguity of entry into chain coverage has been very substantially reduced, thus removing one residual difficulty in the use of the system. Various design improvements have largely removed the disparity which existed between reliable coverage of the lane identification facility and the night-cover of the basic navigational patterns.

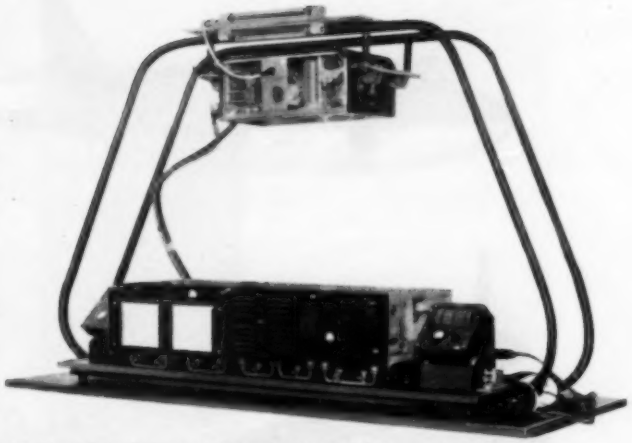
Of several plans of varying status for additional chains in other parts of the world, and for the provision of small chains for gap-filling purposes for helicopter operations, one of the more interesting is Dectra. The Dectra system provides for a track guidance and ranging pattern for the North Atlantic air crossings. This is to be ready for trials about mid-1957 and should, when brought to maturity, make a valuable contribution to the unravelling of the North Atlantic air traffic control problem. An aircraft equipped for Dectra will have all the normal Decca facilities available to him. The prospect opened up for the North Atlantic aircraft crossing the ocean on Dectra and then entering European Decca system coverage is a highly interesting one.

Of the various exhibits in the category of "straight" ground radio equipments one noticed the new Redifon medium-power M.F. beacon transmitter, the outside field installation of the new Pye I.L.S. equipment designed to meet international civil aviation and military needs [see p. 522—Ed.], and welcomed a new Commonwealth exhibitor in Cossor (Canada), Ltd., who made their Farnborough entry with their type 7520.C 50-watt ground V.H.F. transmitter, which is understood to be now the standard equipment on the Canadian airways. To full J.A.N. specification a large number of equipments of this type are in operational service and more are being made for similar purposes.

Although the majority of the new ground broken on the radio side of the show this year was in the further development and refinement of airborne and ground radars, and the emergence of one brand-new airborne radar technique, the more conventional air equipments for communications and navigation purposes were much in evidence. They deserve full mention in view of the growing export of the British transport aircraft for which these radio equipments have been primarily designed.

With the gradual but progressive transfer of the communication job in a modern transport aircraft from a specialist communicator to the pilots, one looks to the growing importance of simplicity of operation and positive selection of function or facility desired. There must be least time- and attention-consuming adjustment once the selection has been made. There is abundant proof that this has received a great deal of attention in the leading equipments on show.

An example in which the requirements of easy pilot operation has been satisfied is the Marconi AD.712/722 range of airborne automatic direction-finding equipments. The tuning system is crystal-controlled in 500 c.p.s. steps, the frequency being presented on a counter-type scale. The conventional tuning of older A.D.F. equipments with its attendant tracking, maladjustment and other errors, is thus replaced by positive frequency selection involving least work on the pilots. This ease of operation has been built into the AD.712 and 722 compasses whilst still retaining narrow-band reception facilities. Both these compasses use fixed-loop antennas only $\frac{7}{8}$in high and requiring a fuselage cut-out of $1\frac{1}{4}$in diameter compared with the 18in cut-out of other British and U.S. designs.



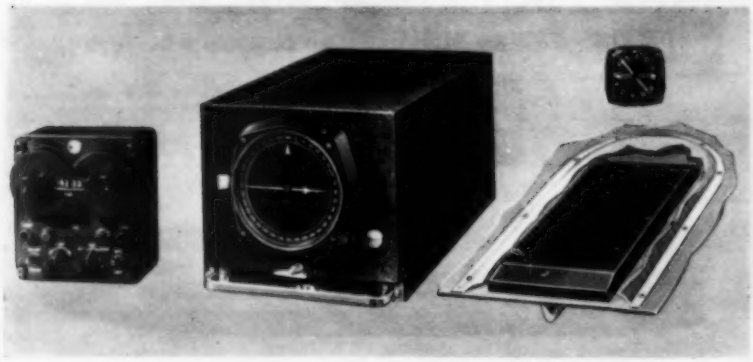
Standard Telephones and Cables' STR.18D pilot-operated H.F. equipment as exhibited at Farnborough. Control units are to the extreme right and left, the other components being receiver drive unit, power and modulator unit, and transmitter; overhead is the aerial coupling unit.

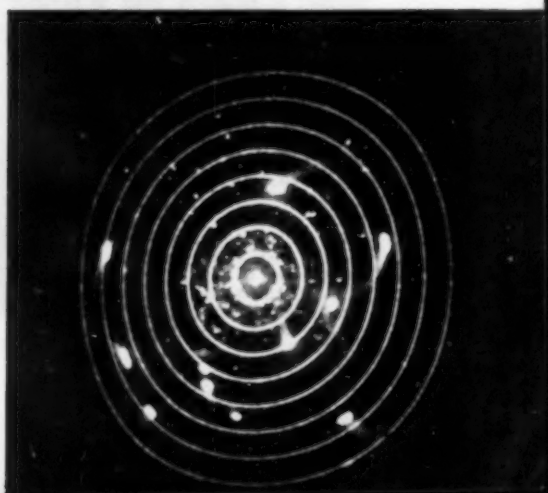
The main H.F. communications equipment for pilot operation shown by the Marconi Company was their AD.307. This is a 200-channel equipment and is fully automatically tuned Optimum performance on all channels without the need for skilled setting-up procedures is thus ensured—an important feature when dealing with a radio unserviceability during a short transit stop. The company also had on show a twin-channel Selcal unit. This is the simple automatic selective calling device by which a ground station equipped with an encoding unit may call the wanted aircraft without the need for continuous listening watch by the crew. Selcal is growing in application, mainly as a calling device on the long-range H.F. communication channels.

The STR.18D of Standard Telephones and Cables, also a main H.F. communication equipment for pilot-operation, is derived from the STR.18C now installed in a number of British civil aircraft. The STR.18C was not a fully automatically tuned equipment but the STR.18D development now incorporates this valuable feature and has, additionally, extended the frequency channels available to two hundred.

A particularly interesting development to the many users of the Standard Telephones and Cables STR.9X V.H.F. equipment was the 44-channel automatic-tuning modification for this equipment, a conversion which should considerably extend its operational life. The forty-four crystals, together with the associated selector and tuning unit, can be installed on the front of the STR.9X. The new control unit is the same size as the old one and uses the same mounting and cabling. The automatic tuning facility obviates the need for tuning on the ground—all that is required is insertion of the appropriate crystals.

(Left) Marconi AD. 712 automatic D/F. equipment; the units shown are controller (with counter-type frequency indication), receiver, fixed loop and indicator. (Right) The S.232 ground radar display of the London Airport traffic pattern as seen on the Marconi stand at the S.B.A.C. Show. Transmitted from 20 miles' range (see heading picture, p. 511), it emphasizes the effect of permanent echo cancellation. The 2½-mile range rings have been somewhat distorted by the angle from which the photograph had to be taken.





Recent and not-so-recent Rolls-Royce/Supermarine affiliations are illustrated here by the "Flight" photograph of the N.113 naval fighter (two Rolls-Royce Avon) and a reader's picture of a Spitfire 14 (Rolls-Royce Griffon). The "Spit" is the property of Rolls-Royce, Ltd.

AIRCRAFT INTELLIGENCE

U.S.A.

Fairchild C-123. Ten of these transports are to be supplied to the U.S.A.F.'s Northeast Air Command for ice-cap transport flying, in replacement of C-47s. They will be fitted with ski landing gear and auxiliary turbojets. Fairchild are reported to be preparing to demonstrate aircraft of the same type for use aboard U.S. Navy carriers. It is hoped that an evaluation might be ordered with the idea of increasing Marine mobility.

Martin P6M SeaMaster. A production order to the value of $121,422,478 has been awarded to Glenn Martin by the U.S. Navy in respect of this high-speed flying-boat.

France

Morane-Saulnier M.S.760 Paris. Several weeks ago the Paris prototype completed the first stages of the official tests for obtaining an American certificate of airworthiness. The second example was then to be put through the entire series of ground tests at Issy les Moulineaux, and the third (about 60 per cent completed at that time) was scheduled to fly during December. The Paris has been ordered into quantity production.

Nord 2506 Noratlas. The 2506 version of the Noratlas twin-boom freighter flew early last month. It incorporates air brakes at the rear of the fuselage, flaps of a new type, and an undercarriage which can be adjusted in height in order to facilitate loading. The Turboméca Marboré auxiliary booster units are standard equipment.

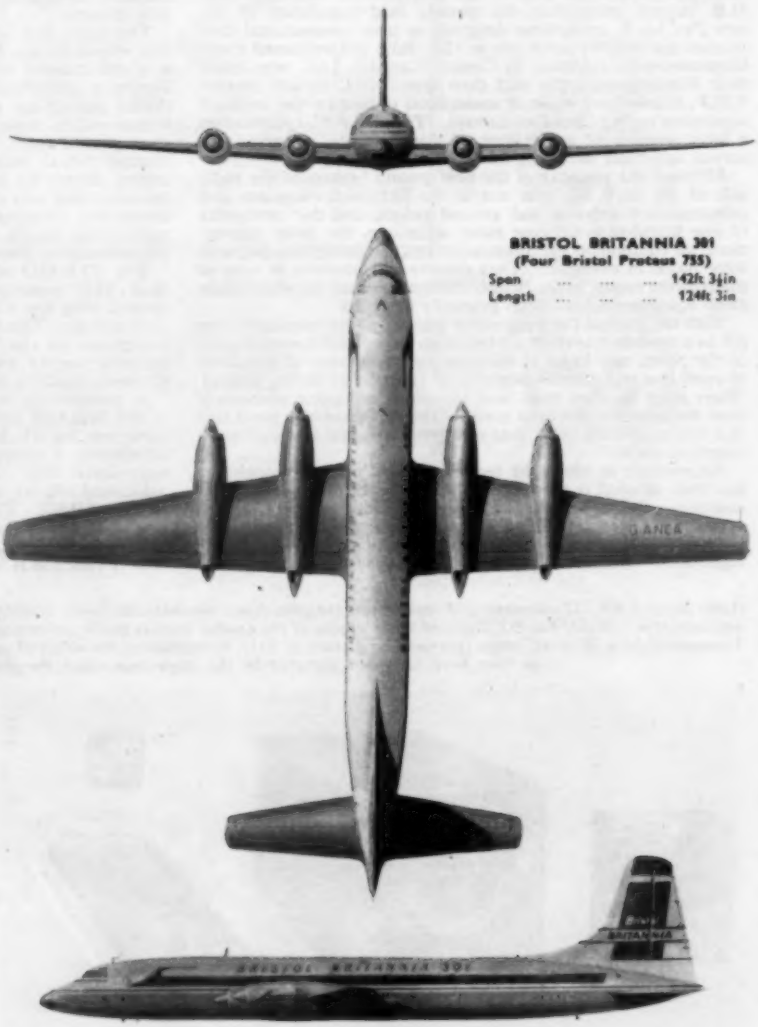
Marcel Dassault Mystère IVA. Production of this fighter is being stepped up in consideration of orders received from NATO, the French Government and foreign sources. Twenty-four have been ordered by Israel and about a hundred by the Indian Air Force.

Italy

New projects. The Italian Ministry of Defence has voted funds to assist the development of a number of new projects, including the Macchi MB.326 jet trainer, the Piaggio P.155 rescue flying boat, an Aerfer jet-propelled target drone, the Agusta X-1 helicopter and a fast military transport to be chosen from Piaggio and SIAI-Marchetti designs.

Japan

Aircraft Supplies. The transfer of 30 Grumman S2F anti-submarine aircraft to the Japan Maritime Self-Defense Force will begin next April and will continue for about a year. The third production plan for the North American F-86F and Lockheed T-33 has been cut to 120 F-86Fs and 30 T-33As because of a budget curtailment. Home production of Cessna L-19 liaison aircraft will begin in 1958. Aircraft purchased by the National Defense Agency during the fiscal year 1955/56 were: D.H. Vampire Trainer, 1; Beech T-34 Mentor, 26; North American T-28B, 1; Sikorsky S-55, 1; Bell 47G, 1. Japan's first indigenous jet aircraft of the post-war years, the T1F1 Orpheus-powered trainer, is scheduled to pass into production during 1959.



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DAY FIGHTERS	*Hawker Hunter* *Vickers Supermarine Swift Mk. 5* *Aerfer Sagittario*
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ALL-WEATHER FIGHTERS	*Avro Canada CF-100*
RESEARCH AIRCRAFT	*Fairey Delta 2* *Holder of the World Speed Record at 1,132 m.p.h.* *Avro 707C*
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TORONTO'S BIG FLYING DISPLAY

U.S. and French Participation

THE BIGGEST air show yet staged in Canada provided a varied display of both military and civil aircraft for over 250,000 spectators at the Canadian National Exhibition in Toronto on September 7 and 8. British, French, American and Canadian machines were flown over the city and the Lake Ontario waterfront of the 350-acre exhibition grounds.

There can be few Canadian cities more air-minded than Toronto, which is hardly surprising in view of its close contact with the aircraft industry. Three major firms—Avro Aircraft, de Havilland Aircraft of Canada, and Orenda Engines—and many ancillary companies are located here. Many of the spectators at the display remembered with enthusiasm last year's show, at which a star item was the formation of three Zlin Treners from Czechoslovakia.

This year's international display was the fourth such consecutive show at Toronto. For the first time French aircraft participated, the Fouga Magister jet trainer making its North American début. Another innovation this year was that the air display was presented on each of two days—the final two days of the Exhibition.

For the first time the Canadian public saw aerial refuelling. Various units of the United States Air Force and U.S. Navy were seen at the show, including a group from the U.S. Eighth Air Force stationed in north-eastern U.S.A. This group brought a Boeing B-47 bomber and KC-97 tanker, flying the two aircraft along the waterfront in a low-level refuelling operation. Another novel item was the appearance of the world's biggest bomber, the ten-engined Convair B-36, which was flown to Toronto from the same base.

While no startling new aircraft were seen at the show, people in central Canada had their first view of the latest addition to the Canadian Navy, in the shape of U.S.-built McDonnell Banshees from the Halifax Naval Air Station. This group of six aircraft put on an aerobatic display at more than 600 m.p.h., including in its performance a number of tight turns in formation. The machines also flew by at slow speed to show how they alight on the flight deck of a carrier.

The two-hour display started with a fly-past of 28 Canadian aircraft in groups of seven. These were led by Canadian-built Lockheed T-33 Silver Star jet trainers, followed by British-built de Havilland Vampires used by the R.C.A.F. Reserves, then by R.C.A.F. Avro Aircraft CF-100s and a group of Canadair-built North American Sabres.

The show ended with the first appearance outside the United States of the U.S. Navy's "Blue Angels" aerobatic team from Pensacola, Florida, flying Grumman F9F Cougar fighters. This group flew in formation of four and in solo displays, carrying out eight-point rolls and flying wing-tip diamond and other formations. They ended a thrilling performance with smoke-plumes in red, white and blue trailing from the Cougars' wing-tips.

Early in the show on September 7, the arrival was announced of a record-breaking flight by an R.C.A.F. CF-100 from Torbay, Newfoundland, to Toronto, made in only 3 hr 8 min. The aircraft was flown by F/L. S. S. Hassey with F/O. R. C. Davidson as navigator. The pilot brought greetings from Premier Joseph Smallwood of Newfoundland to the International Air Show.

Following the opening fly-past of 28 aircraft, a T-33 Silver Star gave an exhibition of aerobatics. This was followed by a demonstration flight showing normal and jet-assisted take-off from the Lake Ontario waterfront by a pair of PBY Canso flying-boats. Development in speed in recent years was shown to the public in speed runs by a World War II R.C.A.F. Mustang and one of the latest examples of the Canadian-built Sabre.

For many Canadians the fly-past of four Lockheed Neptune submarine-hunters was the first time they had seen this latest addition to Canada's coastal patrol armament. The machines flew past with their seven-million-candlepower wing-tip searchlights switched on.

The Toronto-produced Avro Aircraft CF-100 twin-jet intercepter, which weighs some 17 tons, put on a display of aerobatics for the crowd. This was followed by a fly-past of two types of training aircraft, the Harvard and the T-33 Silver Star. Freighter aircraft were next shown—two Fairchild C-119 Packets and a Canadian-built North Star. More runs followed by R.C.A.F. aircraft, including a demonstration of jet-assisted take-off by T-33s, and a massed smoke-trailing formation by T-33s, Sabres and CF-100s.

A mixed formation of F-86s, T-33s (trailing smoke) and CF-100s about to perform a "Prince of Wales's feathers" break-away.

De Havilland Aircraft of Canada next displayed its well-proven Beaver and Otter, giving demonstrations of how these aircraft can land and take off from the water in about 150 yd. The machines were equipped with floats, two of the installations being the amphibious version.

The U.S.A.F. display began with a formation fly-past by four F-86D Sabres from the 15th Fighter Group at Niagara Falls, New York. This was followed by the flight of the B-36 and the refuelling operation. Then the French Fouga Magister made its first North American public appearance with a brisk aerobatic display.

From the Glenview Reserve Base at Chicago, Illinois, a group of four Grumman F9F Cougars gave a display of formation flying—at an estimated 750 m.p.h. The group had made the Chicago-Toronto flight in 39 minutes (on regular scheduled airline service, two hours by Viscount). There followed the Royal Canadian Navy's demonstration of its new Banshees, and a fly-past of a number of civil types comprising Cessna 182 and 310, de Havilland Heron, American-built Royal Gull (of Piaggio design), Piper Apache and Aero Commander 680.

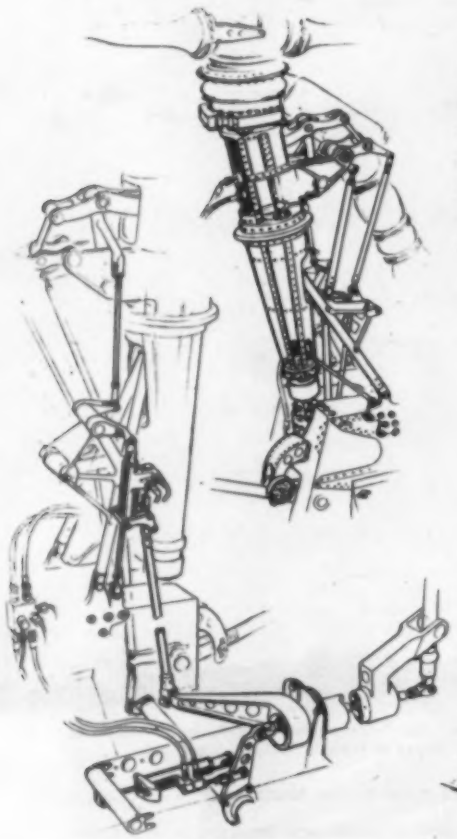
Next, from a New York base, came the Starfire and Scorpion fighters of the U.S.A.F. showing the types of aircraft on duty 24 hours a day at major United States cities—and along the international border, in connection with the three lines of radar warning networks operated jointly by Canada and the United States. The show ended with the display by the "Blue Angels" aerobatic team of seven aircraft.

On September 8 the annual race for the Governor-General's Cup was held for aircraft of less than 4,000 lb gross weight. A 203-mile navigation contest with five turning points, the event was won by Mrs. Dorothy Rungeling in a Cessna 170, who completed the course in one hour and 31 minutes to receive the cup and the $500 prize.

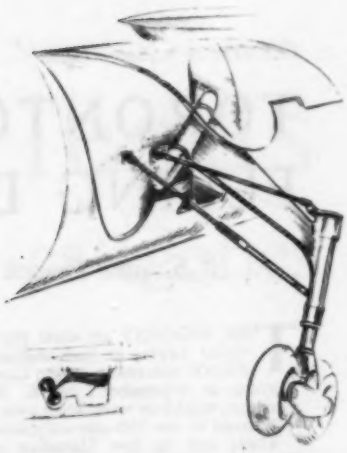
The only static exhibits at the Exhibition having any connection with the air show were two British turbojets, an Avon and an Olympus, which were on view at the British Government display. The R.C.A.F., R.C.N. and the Canadian Army also had recruiting displays at the Exhibition, at which were illustrated the various branches of the Services. The R.C.A.F. showed a D.H.C. Otter, open for inspection by the public, and the Navy had a large model of its new aircraft carrier.

DESIGN NOTEBOOK

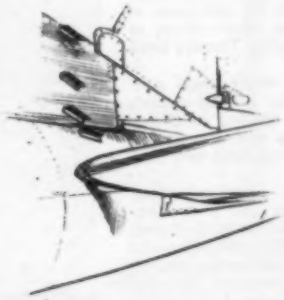
"When found, make a note of" advised Charles Dickens' Captain Cuttle. In these two pages the precept has been followed by "Flight" artists, whose pens and pencils offer, in swiftly sketched lines, a review of new design details that would otherwise call for many hundred words of description.

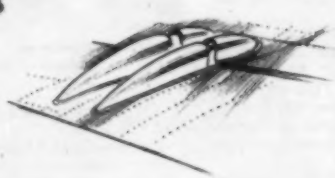


This year the Fairey Ultra-Light Helicopter has been made exceedingly pleasant to fly by the fitting of hydraulically powered controls. The upper drawing shows the port side of the revised rotor pylon, rubber-mounted to absorb vibration. The lower sketch depicts the hydraulic rotor-control system on the starboard side of the pylon.

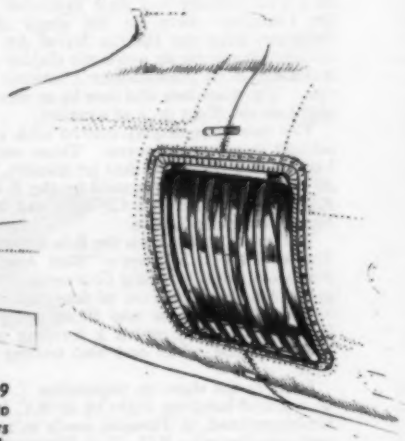


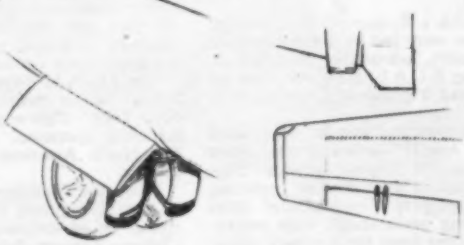
Electro-Hydraulics are responsible for this singularly neat undercarriage project. Designed for very fast aircraft in which it is impracticable to stow the gear in the wing, the complete unit folds upwards and forwards without articulation to lie within the fuselage. The tandem wheels pivot about the leg on retraction.



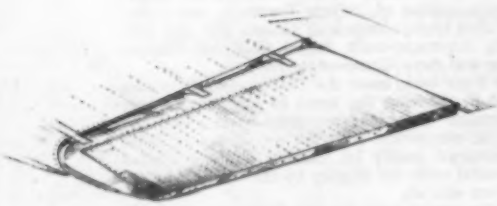


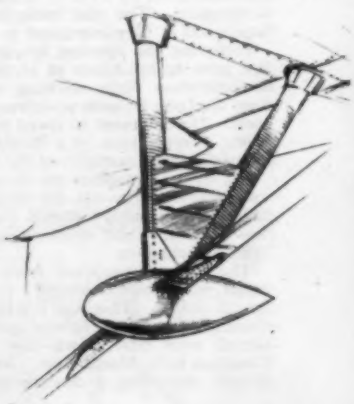
(Below) A detail of the cascade vanes flanking the jet-pipe of the Rolls-Royce reverse-thrust Hunter 6. They form the outlet for the entire mass flow from the engine, the existing pipe being blanked off by twin clamshell doors meeting on the centre line.



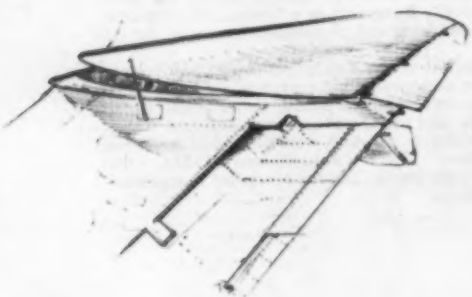


Among the many new features on the Canberra PR.9 (English Electric design, bulk-production assigned to Short and Harland), are the following: tail turbulators (top); twin aileron link fairings (centre); mudguards for the twin nosewheels (lower left); wing turbulators and still-further-extended span (bottom right); and a section of inboard trailing edge again increased in chord and allowed to flex some 0.75in against upper and lower stops.

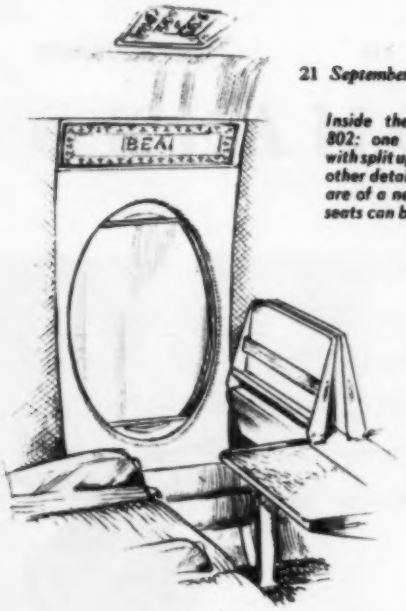




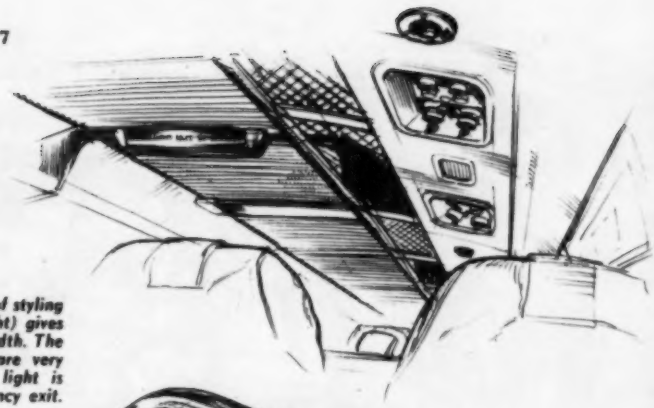
(Left) The blunt aileron trailing edge and variable-incidence tailplane of the Javelin FAW.7.



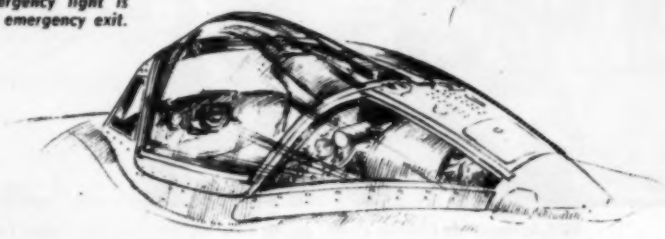
(Right) On the Scottish Aviation Twin Pioneer an acorn has been added where the jury strut joins the main under-wing strut; the earlier joint caused rough air over the tail.



Inside the new Vickers Viscount 802: one of the revised windows with split upper and lower blinds and other detail alterations. The tables are of a new pattern, and the Short seats can be folded against the wall.

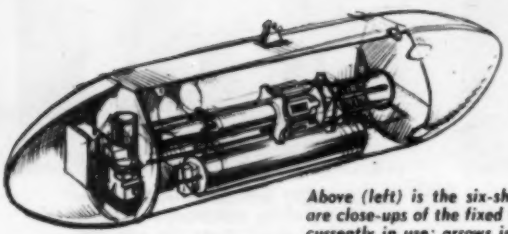


The Viscount 802's new roof styling of corrugated plastic (right) gives an apparent increase in width. The passenger-service panels are very neat and an emergency light is aligned with each emergency exit.

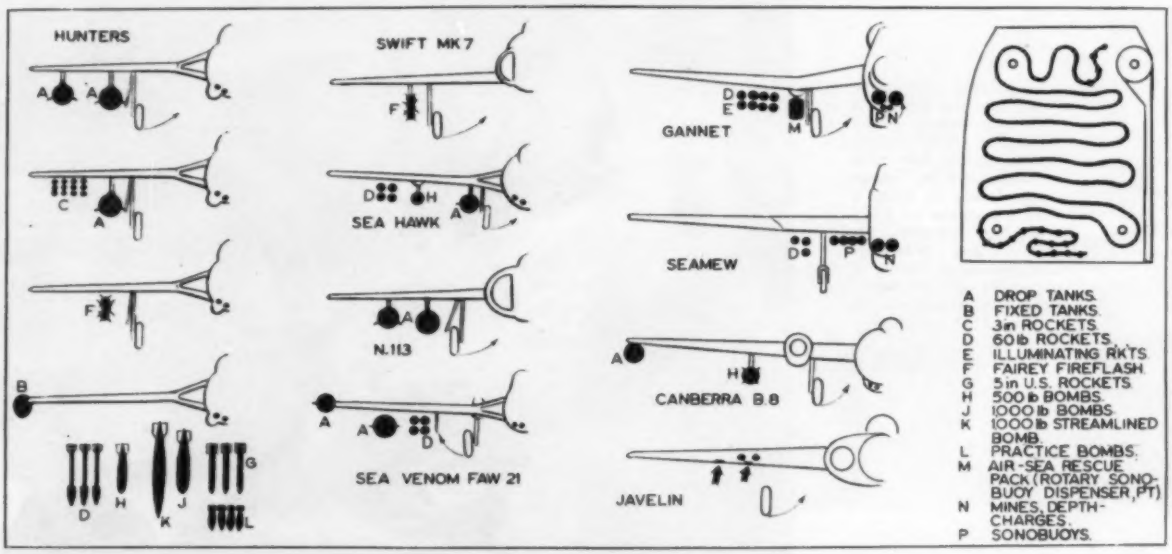


The D.H. Sea Venom FAW.21 and 22 canopy is hinged at the rear and has a blister to port to allow the pilot to sit high. Both crew-members have Martin-Baker ejection seats; the canopy can be jettisoned under water.

A future Gnat development may have a 6 per cent wing with this cross-section. Beaded channel and angle extrusions are used freely, and four rows of tie-bolts are threaded into the upper and lower skin surfaces to act as turnbuckles.

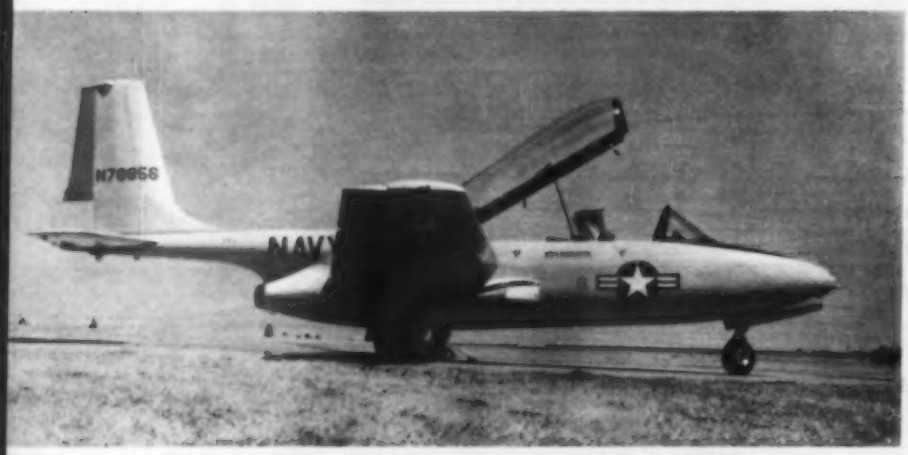


Above (left) is the six-shot Saro rotary dispenser for various stores, and above (right) are close-ups of the fixed tip tank on a Hunter 6. Below are various stores configuration.. currently in use; arrows indicate the pylon positions on the Javelin. The diagram above the letter key shows the disposition of the belt within the magazine on the Hunter's gun-pack. One such ammunition tank, holding roughly 120 rounds, serves each gun.



100F in the shade (and no shade) on the concrete apron at Will Rogers Field, Oklahoma City.

From the rear the Convair F-102 reveals an afterburner, area rule bulges, parachute box, air brakes and ram-air turbine.



The trim Temco TT-1 jet primary trainer, now under U.S. Navy evaluation.

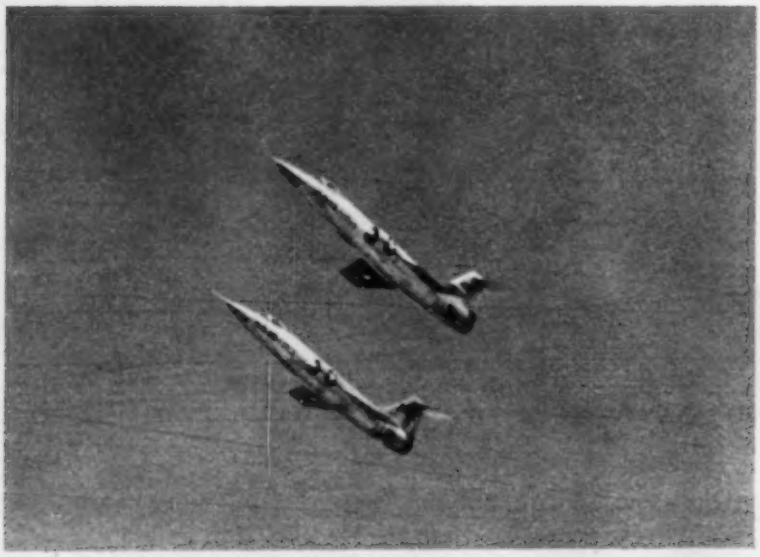
The Bell HSL-1 anti-submarine helicopter is at last entering squadrons of the U.S. Navy. This detail shows the rear end.

On public display for the first time was the actual Chance Vought F8U-1 Crusader Navy fighter with which Cdr. Bob Windsor won the Thompson Trophy by flying a 15 km course at 1,015 m.p.h. Probably the Pratt - and - Whitney - powered day fighter is capable of yet higher speeds if flown under unrestricted conditions.

OKLAHOMA

A view of America's National Air Show, staged at Oklahoma City from September 1 to September 3, pictured by Harold G. Martin and illustrating new aircraft in action and on static exhibition. In particular—and for the first time in any journal—showing Lockheed F-104A supersonic intercepters with their double-shock intakes unmasked.

Startling displays were daily carried out by the U.S. Navy's famed "Blue Angels" team, mounted on Grumman F9F-8 Cougars. Here they are making a slow run, while a probe-equipped Cougar flashes past in the opposite direction.

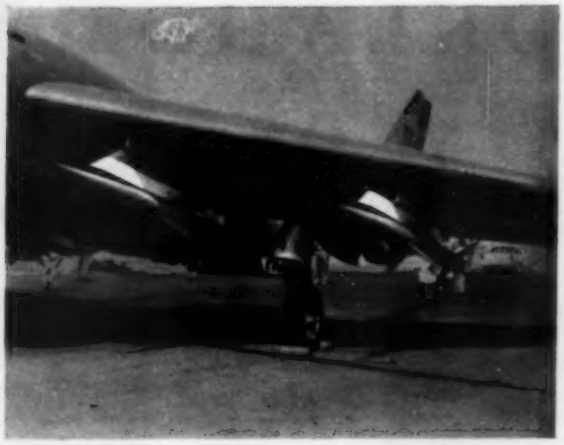


This shot of the second and eighth Lockheed F-104As is the first to show the adjustable double-shock intake. The stained belly of one machine suggests recent armament tests.

A Douglas A4D Skyhawk attack aircraft is seen here being started by a Continental gas-turbine/compressor unit.

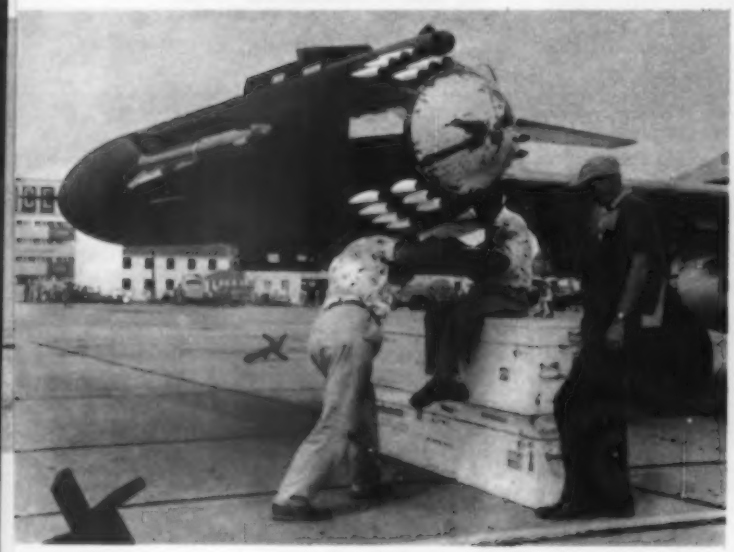
Groups of the U.S.A.F. Air Defense Command are now equipped with the Convair F-102A delta-wing intercepter. Convair are delivering 30 of these Pratt-and-Whitney - engined machines per month from San Diego, and they are the first fully automatic carriers of homing missiles to reach squadron service.

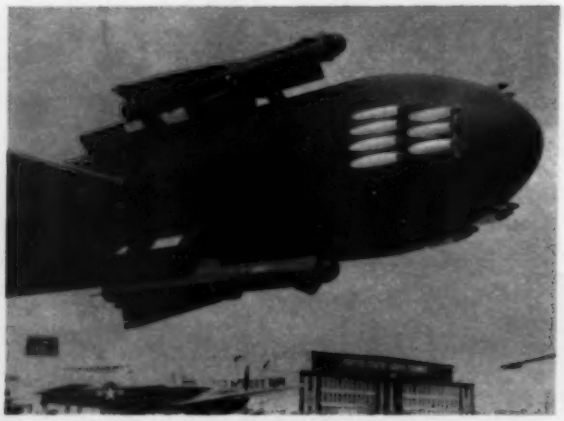
A quartet of Convair F-102A supersonic intercepters makes a stirring sight and leaves the onlooker wondering how the centre of gravity has been brought into line with the centre of lift.



Beneath the port wing of a Chance Vought F7U-3M Cutlass of the U.S. Navy can be seen two Sperry Sparrow air-to-air guided missiles. The outer weapons are toed inwards at some 15 deg.

OKLAHOMA . . .





To the left, above, is a photograph of the starboard armament/fuel pod of the Northrop F-89H Scorpion; immediately above can be seen the inner side of the corresponding pod on the port wing. It houses 21 Mighty Mouse spin-stabilized rockets, three GAR-1 Falcon homing missiles (shown extended for firing) and a quantity of fuel.

One of the more unusual Martin-built Canberras is the B-57E target tug. Below can be seen the banner-containers and towing anchors.

The photograph below shows Sparrow missiles on a McDonnell F3H-2M Demon supersonic fighter of the U.S. Navy.

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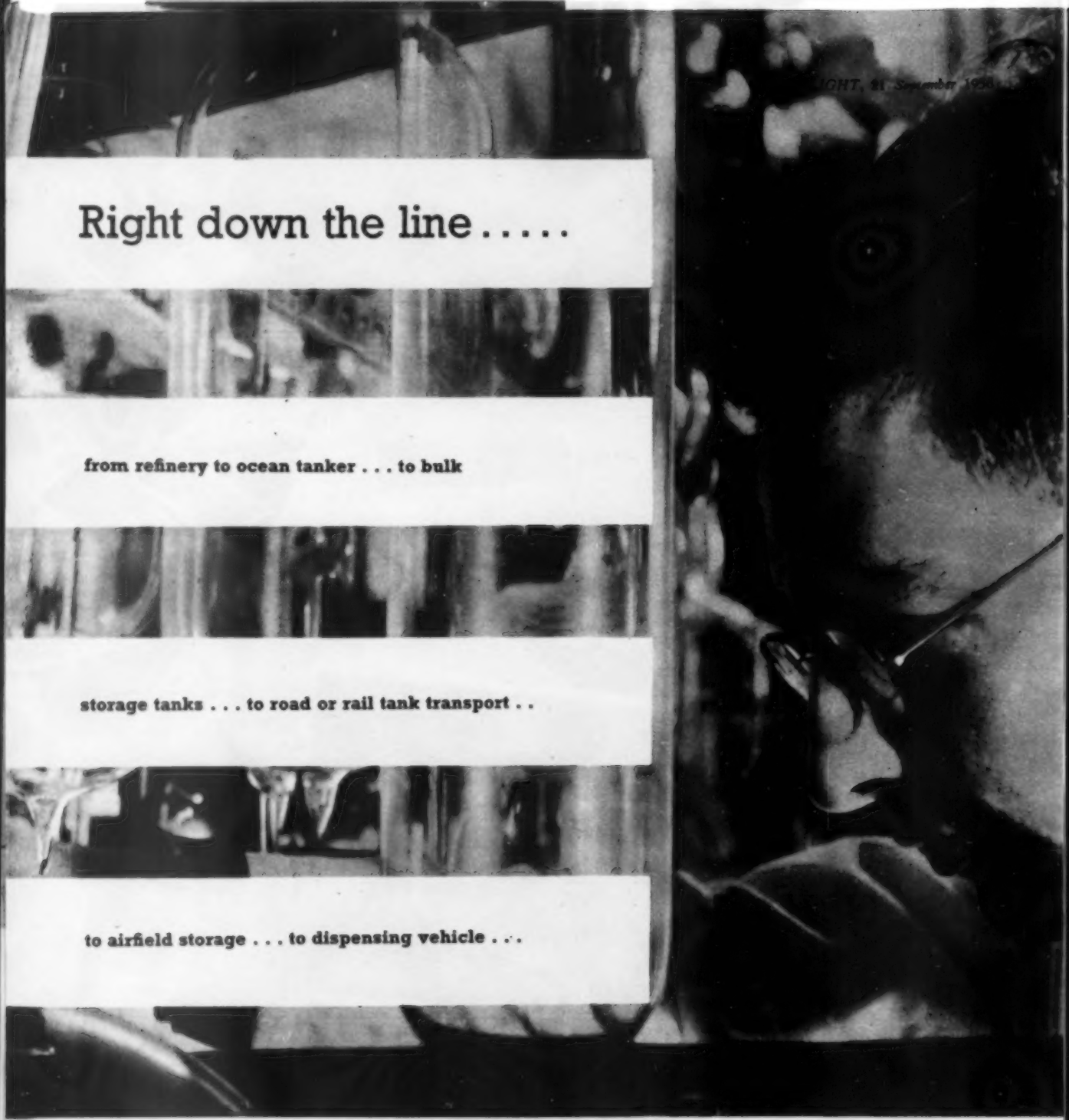

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Viper-powered Italian Trainer

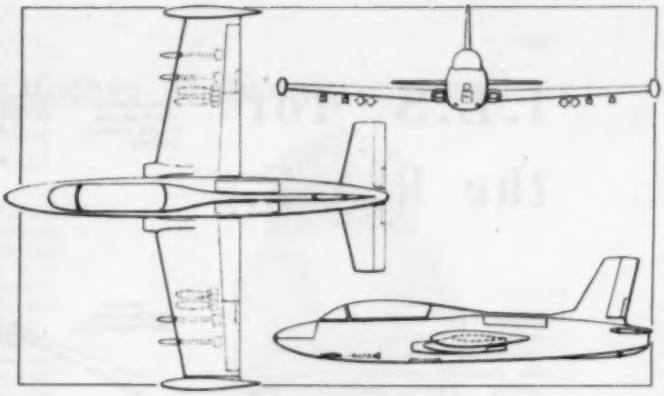
TAKING shape in the Aeronautica Macchi works is a prototype of the MB.326 basic jet trainer for the Italian Air Ministry. A tandem two-seater powered with an Armstrong Siddeley Viper ASV.8 turbojet of 1,750 lb static thrust, it has an air-conditioning system and is fitted with Martin-Baker Mk 4 ejection seats.

The NACA.6A laminar-flow wing section has been chosen for the trapezoidal wing, which is of single-spar type with very closely spaced ribs, but with no spanwise stiffeners. The ailerons are of the Irving sealed-balance pattern and the flaps of Fowler type. The fuselage consists substantially of sheet-formed bulkheads and four main longerons, and is provided with a large opening to allow removal of the engine. Hinged along one side, the canopy is a single-piece structure and can be jettisoned in any emergency, being synchronized to that end with seat ejection. On the lower side of the fuselage is an air brake which opens in about one second.

Fuel is contained in a flexible cell of 190 Imp. gallons capacity, internally divided into two chambers and located behind the cockpit and above the engine intake ducts. The Viper will run for twelve seconds while the aircraft is inverted. Two auxiliary jettisonable tanks, each of 35 gallons capacity, can be fitted to the wing-tips, and from these fuel is transferred to the main tanks by compressed air tapped from the engine. The hydraulic system operates the undercarriage, flaps, air brakes and wheel brakes, and cocks the machine guns.

The front—pupil's—cockpit is, of course, the most complete in respect of instruments and controls. Provision is made for amber screens. The radio consists of one V.H.F. transmitter Type 2 ARC (SARAM 5-52) and one Lear ADF 14 automatic radio compass.

In the armed version—designated MB.326A—provision is made for two SAFAT 0.303 calibre machine guns with 200 rounds of ammunition each; four 13 lb practice rockets, or four 62 lb rockets; four 33 lb practice bombs, or four 100 lb bombs. A G.45 gun camera is fitted in the nose. A number of British accessories, including a Graviner fire-extinguisher bottle, are specified.



MACCHI MB. 326

(Armstrong Siddeley Viper ASV.8 turbojet of 1,750 lb thrust)

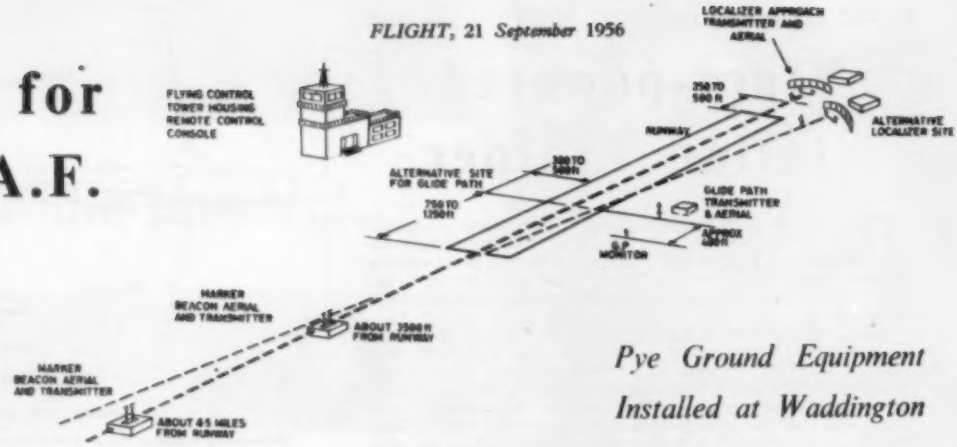
Dimensions	
Span	32.8ft
Length	33.79ft
Wing area	204.5 sq ft
Aspect ratio	5.26
Undercarriage track	7.77ft
Weights	
Empty weight	3,804 lb
Gross weight (with armament)	5,953 lb
Performance	
Max. speed at sea level	404 m.p.h.
Max. speed at 19,700ft	438 m.p.h.
Max. speed at 29,500ft	449 m.p.h.
Min. speed without flaps	94 m.p.h.
Min. speed with flaps	82 m.p.h.
Initial rate of climb	3,050ft/min
Time to 19,700ft	8 min 50 sec
Time to 29,500ft	16 min 30 sec
Normal range at 9,800ft	483 miles
" " 19,700ft	604 miles
" " 29,500ft	715 miles
Range with drop tanks at 29,500ft	1,059 miles
Unstick run	1,509ft
Distance to 50ft	2,165ft
Min. ground run	590ft

Note: All performances relate to the MB.326A (armed) version. Without armament the weight is 220 lb less and performances will be correspondingly improved.

LITTLE FIGHTER MAKES BIG NEWS: THE FOLLAND GNAT

Recorded in this issue is the Indian Government order for 25 Folland Gnat light fighters (Bristol Orpheus turbojet) and the acquisition of a constructional licence. Glimpsed in an ethereal setting is the first Gnat of a batch of six ordered by the Ministry of Supply.

I.L.S. for the R.A.F.



Layout of the Pye ground installation, showing the alternative positions of the localizer parabolic aerials. The monitor aerials can be seen ahead of the transmitters.

Pye Ground Equipment Installed at Waddington

THE first of a large number of Pye I.L.S. ground installations was demonstrated last week at R.A.F. Waddington to British and foreign air force and civil representatives. The equipment is the result of several years' intensive research and development in co-operation with the R.A.E., Farnborough, and the A. and I.E.U., Martlesham Heath, and though it is to become a standard R.A.F. aid it is fully proved for civilian applications and has, in fact, been installed at Geneva and at Hatfield, Herts. Being suitable for use with the present airborne I.L.S. receiving equipment, the Pye ground installation consists of three elements, the localizer transmitters, glide-path transmitters and marker beacon transmitters. All three units are designed to be directed by a remote-control apparatus located in the airport control tower under the supervision of the air traffic control officer. The whole installation is continuously monitored, and warning of any type of failure shows immediately at the remote-control panel.

The localizer aerial array, which may be set up on the runway centre-line or up to 400ft to one side of it, has a parabolic reflector screen which produces a single-sided localizer beam pattern. By eliminating the back-beam in this way the localizer is more stable and simpler, has less distortion and gives a better course line. Negative feed-back from a localizer course-monitor receiver corrects the localizer course automatically after any minor changes in the transmitters' performance. The transmitter radiates two amplitude-modulated signals of 90 c.p.s. and 150 c.p.s. in the V.H.F. navigation band of 108 to 112 Mc/s and the carrier is modulated to a depth of 20 per cent by each tone, while the indicator in the aircraft compares the two modulation levels to give the appropriate "on course," "steer left" or "steer right" signals. The accuracy of this system depends on the accuracy of the modulation depth and, in the past, inaccuracy in measuring instruments used for calibration has caused considerable confusion. To overcome this, Pye have produced modulation depth test equipment which makes a close approximation to absolute measurement of modulation depth, with an error of less than one per cent. Higher standards of calibration are now therefore possible.

The glide-path transmitter and aerial are set up between 300ft and 500ft away from the runway and between 750ft and 1,250ft from the touch-down threshold. They operate on a principle similar to that of the localizer, though the aerials are arranged to give a vertical radiation pattern. The transmitter operates in the U.H.F. band of 328.6 to 335.4 Mc/s and is amplitude-modulated by each tone to a depth of 45 per cent. In this case, too, the modulating frequencies are 90 to 150 c.p.s.

Three marker beacon transmitters operate on the standard frequency of 75 Mc/s, with aerials radiating vertically. Their distances from touch-down are 4.5 nautical miles, 3,500ft and 250ft. They are tone-modulated at 400, 1,300 and 3,000 c.p.s. respectively and keyed in accordance with I.C.A.O. standards.

A comprehensive system of monitoring and alarms is built into the Pye ground installation. The monitor receivers, whose aerials are placed in line with their respective transmitter aerials, measure modulation depth, tone frequency and distortion in the localizer, glide-path and marker beacon signals. Alarm units are designed to prevent the transmission of an incorrect beam. They also fail safe so that even if the system is working correctly, it will automatically switch itself off if a fault develops in the alarm system. If a transmitter fault arises in any of the units, duplicate equipment is automatically switched on and a warning signal produced at the control panel. Alarms will also operate if there is more than ten per cent shift in the approach path, if there is a reduction of more than 50 per cent in power output, or if there is a change of more than ten per cent in beam width.

The complete installation is intended to run continuously unattended, except for maintenance, and the remote-control equipment allows the controller to start, stop and monitor all the transmitters. A speech channel, with a telephone hand-set at transmitter and control panel, will, in accordance with I.C.A.O. requirements, provide emergency transmitting and receiving facilities on the localizer channel. In addition to five failure-warning lights, an identification light and a "system on" light at the control panel show when all transmitters are functioning and all alarm systems are clear.

Comprehensive test equipment, supplied with the installation, includes a course detector for measuring the localizer course modulation pattern, absorption Wattmeters for checking power output of both main and stand-by transmitters, and the new modulation-depth test set.

The Waddington installation uses a laterally offset localizer transmitter whose beam intersects the runway centre line 2,000ft out from the threshold at an angle of 5 deg. It has been arranged in this fashion purely because of space considerations. There are only two markers, the inner of which is in the usual middle-marker position. The glide path is sloped at 3 deg, but can be set at any slope between 2 and 4 deg. Localizer range is between 30 and 50 miles at 2,000ft. Waddington is, of course, the home of No. 230 O.C.U., the Vulcan conversion unit, but at the time of the I.L.S. demonstration, there were no Vulcans on the station.

Other Pye equipment exhibited in a static display included the full range of Pye radio-communications equipment. Being shown for the first time was a new 1 kW V.H.F. ground-to-air transmitter and an industrial closed-circuit television set-up with a camera on a remotely controlled pan and tilt mounting outside the hangar. With this equipment it was possible to survey activities all round the camera as they were presented on a television tube some distance away inside the hangar. Focus could also be adjusted from inside the hangar. Announcements were most effectively put across with the aid of a Pye Transhailer which is a transistorized, battery-operated, hand-held loud hailer with a range of 400 yd or more and weighing only 5 lb.

NEW SURVEY EQUIPMENT

THREE instruments developed and built in Toronto for aerial survey work were recently shown in England for the first time. Products of PSC Applied Research, Ltd., they came to London from Stockholm, where they had been on exhibition at the International Congress of Photogrammetry. One is the T301 Gamble stereo plotter (named after Mr. S. G. Gamble, chief topographical engineer, Department of Mines and Technical Surveys, Ottawa); others were the T246 Mk 3 automatic tri-film processor, and the T232 Mk 7 instrumentation camera.

PSC Applied Research, Ltd., is the Hunting Group's Canadian instrumentation and engineering company. It was formed in 1951 from the technical division of the Photographic Survey Corporation, which had been set up in 1946 to undertake a contract for mapping 125,000 sq miles of Ontario forests. Applied Research products therefore stem from practical experience of designing and manufacturing equipment for aerial survey work and airborne mineral prospecting.

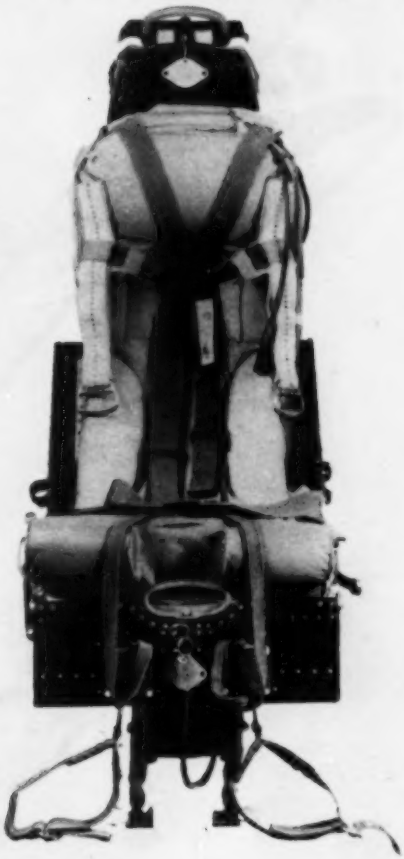
Of particular interest to the aircraft industry, apart from air survey work, is the Mk 7 camera, one of the uses of which is for instrument panel recording. It has been designed for automatic recording on 35 mm film, over a wide range of exposure and interval times. The mechanism provides a basic unit with separate electrical circuits for opening and closing the shutter and actuating the film transport; thus a variety of remote-control applications is possible. Quick-change film magazines, in 100ft and 400ft capacity, are available; and the shutter is of a focal-plane type, with a basic exposure speed of 1/100th sec.

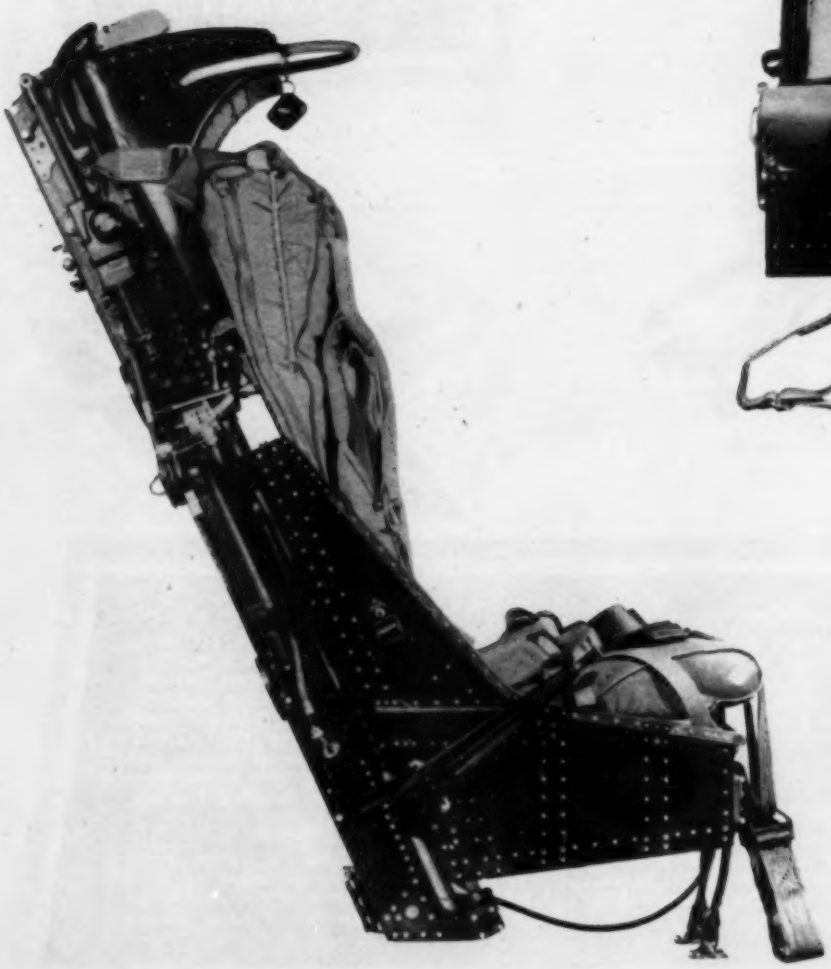
The ejection seat used by air forces of twenty-six nations

The Martin-Baker Patent Fully Automatic Light-weight Ejection Seat, Mark 4, is designed to function efficiently at all operating heights and speeds of which contemporary and projected aircraft are capable. This seat is most compact and weighs only 80 lb. when fitted with the telescopic 85 ft. per second gun. The remarkably low installed weight has been achieved by considerable design ingenuity.

The seat is fitted with the Martin-Baker Patent explosive hood jettison equipment, which enables the occupant to fire himself out of the aircraft with the operation of one control only. When fired, the hood is jettisoned by explosive jacks, followed automatically, a second later, by the ejection seat.

Martin-Baker Ejection Seats have been responsible for saving the lives of many airmen throughout the world.





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NEW ELECTRA DATA

Estimates for Lockheed's Turboprop Airliner

SUCCESSFUL operations with Viscounts augur well for the widespread introduction of turboprops into the American airline field. Seven of the 12 main U.S. domestic airlines are now committed to turboprops for medium-haul operations, representing very many ton-miles of capacity payload to be shared between two types of aircraft—the Viscount and the larger Electra, deliveries of which are to begin in 1958.

The process of development begins, of course, long before the aircraft is in service, and each published change of performance or specification must (with a commercial airliner) be regarded in the light of the competition that the performance presents to the aircraft's contemporaries. Revised weight and performance data for the Lockheed 188 Electra, which were foreshadowed in our Commercial Aircraft issue of July 6, are consequently of quite considerable interest.

The structural-design gross weight of 113,000 lb and the landing design-weight of 95,650 lb remain as quoted at that time; more recently released are the maximum zero fuel weight of 80,910 lb and an operating weight of 59,272 lb. This latter figure is the aggregate of an empty weight of 56,000 lb and operating equipment which weighs 3,272 lb. Additional equipment which must be carried in the international version of the Electra is responsible for an additional 665 lb to bring the operating equipment total to 4,408 lb; this may be broken down into crew and crew baggage 1,090 lb; passenger and service equipment 1,794 lb; removable gear 340 lb; marine equipment 590 lb; navigation equipment 75 lb; unusable fuel and oil 324 lb, and consumable oil 195 lb. The total payload of the Electra of 18,000 lb may be comprised of the weight of 66 passengers (custom version) and 7,110 lb of freight baggage, but operation with additional passengers up to a payload of 21,638 lb is permitted. Reference to figures quoted as at April this year show that an increase in design take-off weight of 3,000 lb, of design landing weight of 2,250 lb and in operating weight of 2,000 lb have been made.

So much for weight differences; what of the effect upon performance? The April figures remain largely unchanged. The mean cruising speed is given as 406 m.p.h. at optimum altitude and zero wind conditions—in fact the actual cruising speed varies between 410 m.p.h. at short ranges and 400 m.p.h. over the maximum stages of about 2,600 miles. A slight improvement on the performance figures quoted earlier is, however, apparent from a study of the payload-range curves, which show that the 21,638 lb payload may be carried up to 2,300 miles cruising at 80 per cent of the normal rated power available—figures that substantiate the maker's claim for the Electra's ability to operate the longest medium-haul distances—necessary on the longer U.S. domestic flights.

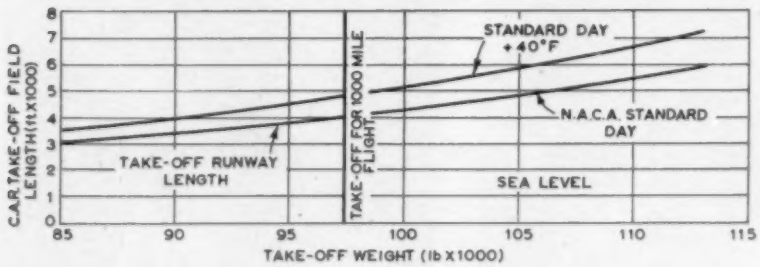
More comprehensive figures are now quoted and a curve given (it is reproduced on this page) to show the take-off field lengths required under varying conditions. In drawing the curve it has been assumed that an engine fails at the most critical point in the take-off run, whereupon the airscrew feathers automatically. Performance at sea level for a standard day and for standard plus 40 deg F temperatures are shown. With a take-off weight of 97,432 lb necessary for a 1,000 mile flight, a field length of 4,080ft is required on a standard day, and 4,900ft on a hot (standard plus 40 deg F) day. Consideration of take-off at the maximum weight of 113,000 lb shows that field lengths of 5,820ft and 7,240ft respectively are required. Normal day-to-day operation (without critical failures) at a typical configuration—take-off weight of 112,000 lb, 66 passengers and their baggage, maximum cargo loading and 34,600 lb fuel—would require about 3,920ft for the Electra to become airborne on a standard day.

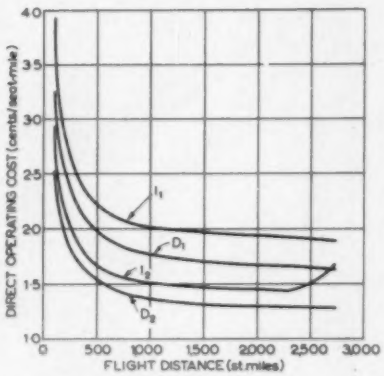
The normal landing weight of the Electra will be 85,030 lb, for which a field length of 4,920ft is required at sea level and normal temperature. This field length is based upon the requirements of U.S. Civil Air Regulations, and includes a factor of 0.6, but does not take into account any form of reverse thrust. At the maximum gross landing weight of 95,650 lb this length is increased to 5,400ft. Landing with two hours of fuel in the tanks would account for 7,200 lb of the total landing weight of the domestic version, and 7,340 lb in the slightly heavier international version.

An interesting comparison can be made between the cost-range curve shown on this page and that shown in *Flight* for July 6. It will be seen that the earlier figures have been increased by an appreciable amount.

The first Electra is due to fly in October 1957 and, by means of a pre-planned programme, the production rate is scheduled to reach 132 aircraft per year by late 1959. The number of aircraft at present on order is 128.

Operating costs of the Electra as a 66-seat international and domestic custom version (I_1 and D_1) and an 88-seat international version (I_2) or 85-seat domestic version (D_2) are compared on the right. The take-off performance curves below are drawn to Civil Air Regulations requirements, which make provision for engine failure at the critical take-off point followed by automatic feathering of the 13ft 6in diameter Aeroproducts four-blade airscrew.





CONTINENTAL CONSTRUCTORS' CONFERENCE

THE second European Aeronautical Congress is to be held at Scheveningen, Holland, from September 25 to 29. The delegates represent the technical-scientific branches of the aircraft industry in countries associated with A.I.C.M.A. (Association Internationale des Constructeurs de Matériel Aéronautique), and membership of the Congress is also open to those engaged on aeronautical work in Austria, Finland, Greece and Yugoslavia.

Papers on many different topics will be given, several of the most important dealing with the introduction of jet propulsion into civil aviation, a subject which has been recommended for particular study.

There will also be visits to places of aeronautical interest, and (as mentioned in our issue of August 24) a demonstration of the S.N.C.A.S.E. S.E.210 Caravelle and the Fokker F.27 Friendship at Schiphol Airport, Amsterdam.

The rise of a third turboprop airliner star—the Britannia—has recently been observed (without much need for a long-range telescope) in the U.S. skies; and despite Bristol's insistence that the Electra and the Britannia "are not comparable, the Britannia is a much larger aircraft," the Electra performance yardstick is sure to figure in an assessment of the British challenger by the president of an American airline with a cheque-book for equipment-purchasing in his pocket.

ART FOR FLYING'S SAKE

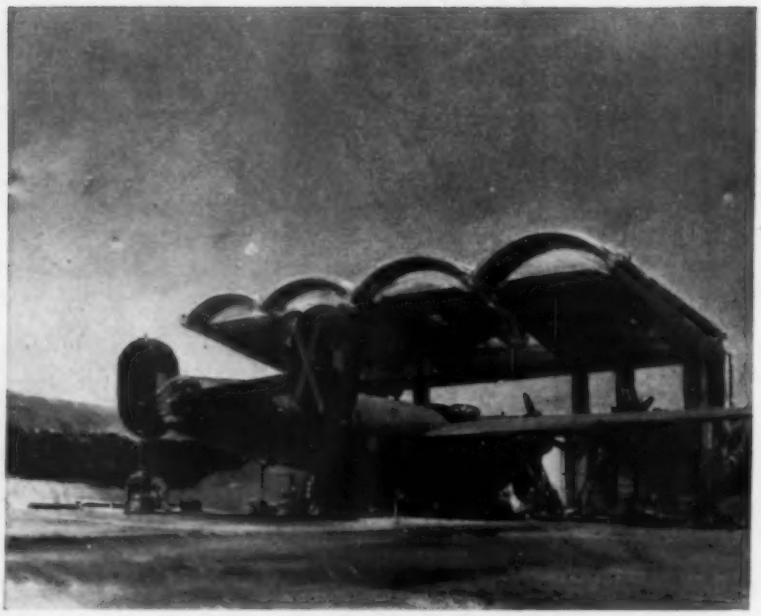
OPENED by Sir Frederick Handley Page on September 11, the third annual exhibition of the Society of Aviation Artists at Guildhall, London, will continue until September 29. During this period, a unique opportunity to study the interpretation of aviation history through painting—one of the declared objects of the Society—is presented. Lay members who may wish to encourage the search for young artists and make use of the services of the Society are invited to join.*

The 1956 exhibition is characterized by the variety of subject matter which has been chosen and the vigour with which many of the subjects have been presented. A specialized show of this nature must be judged by standards peculiar to the action portrayed. Aviation art at its best must express something of the heady beauty, the awesomeness of flight: that half-recognized awareness of magnificent solitude that is recalled in John Magee's lines:—

. . . the windswept heights with easy grace,
Where never lark, or even eagle, flew,
And with silent, lifting mind I've trod
The high untrespassed sanctity of space.

This sense, and the rhythm, the movement and speed of aeroplanes, are never easy to portray—nor as easy to master as the draughtsmanship required to draw a photographic representation of this machine or that; and it must be a criticism of many of the pictures displayed that an impression of the aeroplane's essential swiftness of

*They may do so at an annual subscription of one guinea. The Society's offices are at 23 Albemarle Street, London, W.1.



FRANK WOOTTON: *Retraction test—Salbani, India, 1945.*

DAVID SHEPHERD: *Immortal hero.*

KEITH SHACKLETON: *Dr. A. P. Thurston, M.B.E.*

KENNETH McDONOUGH: *Air lift 1916—A B.E.2C aeroplane ready to drop food into beseiged Kut, Mesopotamia.*

DAVID SHEPHERD: ***"F" For Freddie did not return.***

movement—the vital restlessness—is lacking. Only composition can produce this much-desired effect, and many a device is employed to gain the end. A favourite, if obvious, gambit is the take-off scene—the aircraft climbing, wheels half-retracted, the runway and buildings slipping away behind.

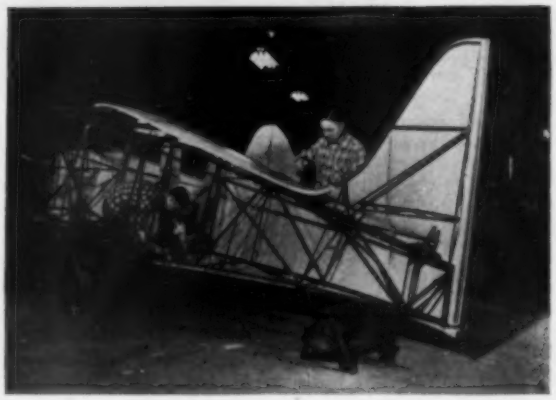
In a really vigorous water-colour of this genre, *Super Sabre Blast-off*, G. Davison Coulson makes the best use of the dramatic quality of the open, thrusting nose and swept-back surfaces. Outstanding of the airborne subjects is, perhaps, David Shepherd's *"F" for Freddie did not return.* The portrayal of war in the air has an intrinsic appeal, and this action study of pervading gloom and dogged purpose, accentuated by the ominous cloud awaiting the crippled Lancaster, is one from which it is not easy to turn away. This artist is justifiably well represented; another excellent picture is his latest, bearing the title *Night shift at Seattle—another eight-jet B-52 Stratofortress rolls out, August 1956.* Aircraft on the ground present a quite different set of problems to the artist, and there is strong decorative design and dramatic appeal in the manner in which the open hangar has been used to accentuate the vast wing span.

Artistically, such scenes are generally more successful than those in the air; the criteria of interest and (particularly) design and composition, are more easily met. The arresting shape of the arched roof over the foreground Liberator in Frank Wootton's *Retraction test—Salbani, India, 1945* would stand as a picture on its own; yet the aircraft adds essential animation to the scene. Mr. Wootton's other canvas, depicting Javelins of 46 Squadron standing on drying, still-puddled tarmac, captures some hint of the visual appeal of aircraft felt but left unexpressed by the usually inarticulate pilot or engineer.

The range of pictures on display is commendably wide, and some brave attempts have been made at abstract interpretations, perhaps as protests against the closely detailed work of photographic quality from which aeronautical studies are prone to suffer. To mention but one of the abstracts, *The glory at the Anti-solar point*, by W. Howard Jarvis, is individual to a degree and well composed into the bargain, although perhaps of limited pictorial appeal. There can be little doubt, however, that the 120 pictures selected by the committee will satisfy most tastes.

(Left) **KENNETH CHILD:** ***Exploration of upper atmosphere by rocket.***

(Below) **DEBORAH JONES:** ***The lonely place—Oxfordshire.***



The Taylorcraft Topper and (right) two stages in its production with a Fiberglas skin. The halves of the skin are seen on removal from the mould in which they have been cured, and in the lower picture they are being offered up to the steel-tube fuselage.

GLASS-FIBRE SKINS

Successful Development by Taylorcraft

AFTER an extensive period of experiment and development, Taylorcraft Inc., the well known American manufacturers of light aircraft, have attained considerable success in the use of moulded Fiberglas as a covering for steel-tube airframe structures. They are now using the material in this manner for production versions of the Topper, illustrated above, and the Ranch Wagon (the Topper is an agricultural version of the latter).

The company's use of Fiberglas in this way originated from a series of investigations into the possibilities of press-forming complete light-alloy fuselage halves, broadly on the lines commonly employed in car-body production. It was found that the necessary large dies, made to fine limits, would prove uneconomic for the production runs visualized; attention was therefore turned to the possibilities of glass-fibre, which could be moulded on relatively inexpensive dies.

The material offers a number of advantages, chief among them being its resistance to corrosion, its temperature-insulation properties, and the fact that it cannot easily be torn, dented or otherwise damaged. Repairs can, in any case, be easily made with the aid of glass-cloth, resin, and a putty knife. Major components can be "spliced" into place.

Taylorcraft have found that a Fiberglas airframe structure, in comparison with a comparable all-metal assembly, can be produced in one-fourth of the engineering man-hours, one-sixth of the production man-hours, and 20 per cent of the tooling and equipment costs.

Although Taylorcraft are the first to use glass-fibre so extensively, its use for various components (e.g., radomes, tip-tanks, fairings and so forth) is well established on both sides of the Atlantic. The U.S. Air Force recently completed a 1,000-hour evaluation of a North American T-6 (Harvard) equipped with Fiberglas-covered wings; and the U.S. Navy is using the material successfully for the 17ft rear fuselage of the Lockheed Neptune.

EXECUTIVE OWNERSHIP ANALYSED

WITH typical American thoroughness in such matters, the Piper company annually sends out a questionnaire to owners of its aircraft in order to assess the pattern of utilization and customers' requirements. This year's answers, duly analysed, provide an interesting picture of the executive owner, a type practically unknown in this country. A total of 95.7 per cent of Tri-Pacer owners regard their machines as a necessary part of business and private life and expect to continue to own an aircraft in future. Expansion of business as a direct result of using the aircraft is reported by 88 per cent of owners. They agree to a man that their aircraft are and will continue to be essential for business and personal travel.

The average Tri-Pacer owner is revealed by the questionnaire to be a businessman and private pilot with a total of 1,681 hours' flying. He flies his Tri-Pacer (72.8 per cent of those sold are fitted with "full super custom radio equipment") for some 317 hours each year. He has almost ceased to use airlines or railways and spends half his travelling time in his aircraft and half in his car. His aeroplane covers 14 miles per gallon of fuel and flying costs compare favourably with those of travelling by car.

Manufacturers constitute 19.5 per cent of all owners, ranchers and farmers 10.3 per cent, doctors and airport operators 9.1 per cent and, in decreasing percentages, the remainder are contractors, wholesale merchants, real estate and insurance firms, retail-store owners, car dealers, salesmen, engineers, oil field workers, and missionaries and other church workers; also in the remainder are a widely diversified group of businessmen, government agencies, flying clubs, sportsmen, housewives and retired couples interested solely in air travel for pleasure.

As for the Piper Apache, the "average" owner is not, it seems, so easily defined, for 41 per cent of users are private pilots while 59 per cent hold commercial licences. The average Apache pilot has flown 4,091 hours and flies 505 hours in the aircraft each year. Operating costs for 58.6 per cent of owners compare favourably with car running costs.

Owners are classified as 36.2 per cent manufacturers and executives, 13.0 per cent contractors, 8.7 per cent oilfield workers and, in decreasing percentages, real estate and insurance firms, business distributors, lumbermen, advertising agencies, airport operators, dairymen and doctors. Only four per cent of Apache owners make no business use at all of their aircraft, but a large number of them state that the machines are used for holiday travel by executives.

R.Ae.S. ASSOCIATE EXAMINATIONS

THE Royal Aeronautical Society has issued the pass list for its Associate Fellowship examination last June, Part II of which was held under both the old and the new syllabus. Names of the successful candidates are as follows:—

Part I.—W/C. S. D. Amin (India), D. O. Challis, D. H. Chester, D. W. Cocking, F/L. B. Husain (Pakistan), F/Cdt. G. G. Jones, D. W. Howe, B. Rothnie, H. R. Satyanarayana (India), P. G. Simpkins, G. S. Uppal (India), D. W. Wingate.

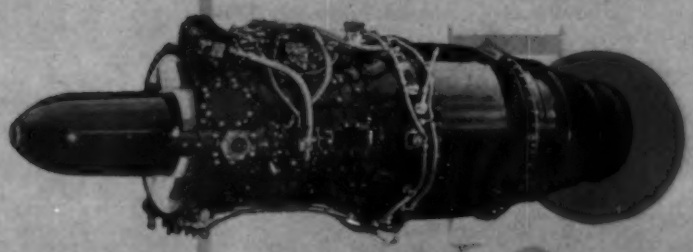
Part II (old syllabus).—Miss R. B. Fox, B. Gumpel, E. T. Harris, C. S. Krishnamoorthi (India), J. F. Leigh, T. L. Narasimhan (India), B. N. Vaman Rao (India), C. Russell.

Part II (new syllabus).—C. G. Brown, J. D. Burley, D. A. Drinkald, G. McGuire, H. Phillips.

Progress is no gamble...

In the design of aircraft engines, any form of speculative development—we think of it simply as gambling—may be not merely irresponsible, but positively destructive. Apparent but in the long run illusory success can cause irreparable loss of time, resources and initiative. That is why we cleave resolutely to the policy of systematic development which has produced such engines as the Viper turbojet, power plant of Britain's first basic jet trainer.

That is why we are ceaselessly exploring and extending the potentialities of these proven types, in constant, reliable readiness for the requirements of aircraft evolution.



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Canada—a nation that believes the North Atlantic Treaty Organization must be a power for peace as well as for protection—has made, and continues to make, every possible contribution. For the "Wings of NATO", the Royal Canadian Air Force directs, supplies and maintains an entire air division equipped with one of the finest aircraft in European operational service—the Canadair-built F-86 Sabre Jet.

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CAN-61KT

Above, the Shackleton-Lee Murray S.M.1 of 1932. Right, Mr. W. S. Shackleton.

137 NOT OUT

"Bill" Shackleton's Unique Record of Aircraft Types Sold: Celebrating a Quarter-century

NO FEWER than 137 different types of aircraft have passed through the hands of W. S. Shackleton, Ltd., since the formation of the original company (Shackleton and Lee Murray) just twenty-five years ago. The total number of aircraft sold abroad during this period is over 1,500. Among recent sales are 54 de Havilland Chipmunks for Australia—an appropriate transaction, for it was in Australia that the company's story began.

A news item under the heading "Airisms from the Four Winds" in *Flight* of May 29, 1931, read:

"His many friends will be glad to learn that Mr. W. S. Shackleton is shortly returning to England from Australia, whither he went some years ago on account of indifferent health. Mr. Shackleton, who will perhaps be best remembered as the designer of the little A.N.E.C. monoplane, and later the Beardmore "Wee Bee," has now wholly regained his health, and on his return to the "Old Country" he will, in conjunction with Mr. Lee Murray, who is generally regarded as one of the soundest pilots in Australia, establish a business as consulting engineer, chiefly in connection with advising on the suitability and purchase of aircraft from England by Australian, New Zealand, and New Guinea operating companies or private individuals. Mr. Shackleton has been chief designer and engineer to the Larkin Aircraft Supply Company. Shackleton and Murray have between them a very thorough practical knowledge of Australian conditions, and they should be very successful in attaining their ideal of developing a reliable and unbiased liaison between aeronautical interests at home and in the Southern Hemisphere. . . . Mr. Shackleton and his family are travelling home by boat, while Mr. Lee Murray is flying his Desoutter monoplane across Canada and the United States to study conditions there . . ."

Shackleton and Murray started business at 175 Piccadilly, London, in September of that year. The partnership could not have begun at a more difficult time, for there was then a period of worldwide depression. For the first two years the final balance-sheet figures were in red but, in the third year (on a basis of no salary or expenses to the two principals), a profit of 19s 7½d was recorded—and was ploughed back.

The first aircraft to be sold by the company was a D.H. Metal Moth, which went to Dick Allen, an airline pilot, of Melbourne. Allen flew the machine out to Melbourne from the U.K. following long-range modifications by Shackleton and Murray.

In 1932 the two partners decided to design a small two-seater aircraft utilizing a pusher propeller and powered by a 60 h.p. Hirth engine. A venture quite outside the firm's normal commercial activities, this project bore the designation Shackleton-Lee Murray S.M.1, and was based largely on the ideas formulated by Murray after flying the Curtiss Junior, a similar type, in the U.S.A. The S.M.1 first flew early in 1933.

At about this time Lee Murray joined the de Havilland organization, and worked in turn for the D.H. companies in Canada, England and Australia. He now lives in retirement in Tasmania.

Shackleton was now on his own but, in 1934, the economic tide began to turn and the first big orders came in from New Guinea. Four Ford Trimotor 4-ATs and 5-ATs, together with big stocks of engines and spares, were shipped out from the United Kingdom to Lae. The four Fords continued in service, amassing over 50,000 flying hours, until the Japanese invasion of New Guinea.

Business continued to prosper and, early in 1935, a limited company was formed with W. S. Shackleton and J. H. C. Beard as directors. Soon afterwards Mr. Shackleton visited the U.S.A. to purchase further airframe and engine spares.

Among the more interesting aircraft supplied by Shackleton before the war were a large number of ambulance versions of the Fox Moth for the Australian Flying Doctor Service and, in 1934, a Fairey Fox flown by Ray Parer and Geoffrey Hemsworth in the 1934 MacRobertson Race. Another was the special Airspeed Envoy fitted with Wolseley Aries III engines and owned by Sir William Morris, now Lord Nuffield, which was sent to Australia to found the nucleus of the large fleet now operated by Ansett Airways.

During this pre-war period, the firm handled most types of British light aircraft. Names which have their own nostalgia come to mind, such as the de Havilland Moths—Puss, Leopard, Hornet, Fox, and Minor; the Miles types—Hawk, Falcon, Merlin, Whitney Straight, Monarch; the Percival Gull, Vega Gull, Mew Gull and Q.6 (Shackletons sold the first three of these to be built). Others include the B.A. Swallow, Eagle and Double Eagle; Comper Swift; Avro Avian, Cadet, Tutor and Commodore; Blackburn Bluebird and B.2 trainer; Parnall Elf and Heck; Westland Widgeon; Short Scion; G.A. Monospar and Cygnet; Tipsy; Wicko; Redwing; Heston Phœnix; Mosscraft; and the Taylorcrafts.

During the 1939-45 war Mr. Shackleton worked in the Directorate of Scientific Research at the Ministry of Aircraft Production, in connection with the development of troop- and cargo-carrying gliders. On completion of this work he was engaged by the Indian Tata company as consultant for their repair and maintenance depots throughout India.

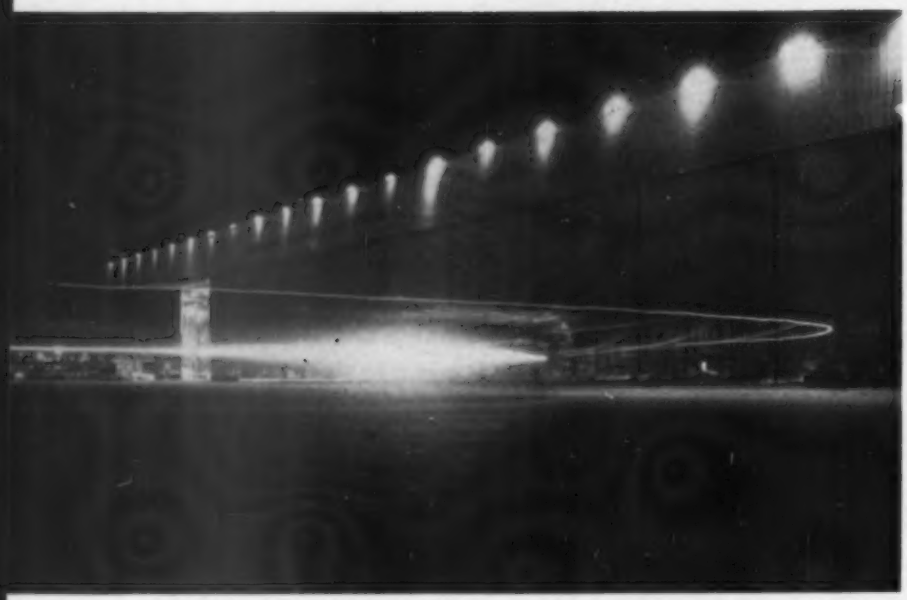
In spite of the war the firm's aircraft sales continued, albeit on a very different basis. Early in 1940 instructions were received from Guinea Airways, Ltd., to purchase two new Lockheed 14 aircraft which had just been acquired by Aer Lingus. These were flown out to Australia in circumstances which, the company states, "if written-up would make a detective thriller read like a child's book of verse." These aircraft were intended for the strategic run from Adelaide to Darwin; one of these machines, still flying, had recently logged some 25,000 hours. Another wartime order was the shipment of 32 Tiger Moths to India in connection with the Empire Air Training Scheme.

After the war, S/L. Beard rejoined the firm, and Mr. Shackleton made a five-months tour of all the major aircraft companies in Canada and the United States, with a view to studying civil aircraft development. The firm quickly got into its stride again and many pre-war and wartime aircraft were sold in Europe and exported to all parts of the world. The main types involved were Tiger Moths, Proctors, Magisters, Piper Cubs, Consuls, Oxfords, Rapides, Fairchilds, Beechcraft, Ansons, Dakotas, and Lodestars. In 1948 Beard resigned his directorship to settle in Australia with his family. As production of new British types began, Shackleton's sales switched to Autocrats, Auster 5s, Geminis, Messengers, Aerovans, Avro XIXs, Doves, Herons, Princes, Marathons, Vikings, Wayfarers and the many new Auster civil types. Also included were a number of Short Solent flying boats and a double-deck Bermuda for Australia.

On Mr. Shackleton's staff at the present time are his son, Keith Shackleton (director, sales manager and demonstration pilot), who is also well known as a dinghy sailor, ornithologist, artist and author; Mr. Frank Dismore, D.F.C. (director, general manager and demonstration pilot), previously with the Royal Aero Club; Mr. D. E. Hayward (shipping and despatch) who handles the shipping and despatch department and supervises most orders for engines, spares and equipment; and Mr. T. S. Irving, the company secretary.

It is indeed a varied and interesting record that the company has to look back on over the past 25 years. It is worth recalling that Shackletons provided the first office accommodation for Mr. Louis Armandias when he came over from France to found the British Messier organization. Hessell Tiltman and Marcus Langley were also provided with desks and drawing boards when they started in partnership to found the Tiltman Langley company; and, similarly, Capt. R. J. Ashley and his staff made their start with W. S. Shackleton, Ltd., when they founded the original Skyways, Ltd.

The most recent type of aircraft to be sold—the 137th type—is the Auster Alpine delivered to the air patrol of the Automobile Association. Having over the past twenty-five years sent aircraft to almost every conceivable part of the world, from Iceland to Madagascar and from the Canary Islands to Fiji, the founder of the company now looks forward to selling second-hand Douglas D.C.8s and Boeing 707s in the 1960s.



CIVIL AVIATION

This unusual picture was taken during exterior lighting tests with the Boeing 707 prototype at the Seattle flight centre. The various traces were left by the aircraft's landing, taxi, navigation and anti-collision lights.

BRITANNIA SETBACK

IF the in-service date of the Britannia seems to be an elusive—and currently receding—will-o'-the-wisp it is because B.O.A.C. and Bristol have agreed that remedial measures to overcome the icing difficulties must be perfected first. One of the latest series of proving flights showed that the flame-outs which occurred over Africa were repeated in the monsoon area near Calcutta even when the modified cowlings were fitted; and after a meeting between Sir Reginald Verdon Smith of Bristol and Mr. Gerard d'Erlanger and Mr. Basil Smallpeice of B.O.A.C., a statement was issued deciding "with great regret, that introduction of the Britannia 102 aircraft into commercial operation must be deferred." While Bristol are tackling the problem with the "greatest urgency," it seems clear that further proving flights—the real test laboratory is in tropical thunderstorm conditions at 20,000ft—must take place after modification and that this may take some time.

Mr. Peter Masefield, who is in America to discuss certification of the Britannia (which he hoped would be obtained by early next year), said that the problem was "fully understood" and that he would "confidently expect this problem in extreme [atmospheric] conditions to be eliminated during the next 30 to 60 days." B.O.A.C., meanwhile, already badly hampered by equipment problems, must continue its present advertised services with its existing fleet. The first Douglas DC-7Cs are expected to start scheduled North Atlantic services in January.

QANTAS RE-EQUIPS

MR. ATHOL TOWNLEY, Australia's Minister of Civil Aviation, has announced that Qantas Empire Airways, Ltd.—half-owned by the Australian Government—are to buy seven Boeing 707-138 jet airliners for use on their Pacific route to San Francisco and on the Kangaroo route to London. By purchasing the smaller version of the American airliner, Qantas hope to capitalize on earlier delivery dates—May to September 1959—than would be possible with the intercontinental model and to gain the benefit of current military experience with the Pratt and Whitney engines to be installed. The capital cost of the aircraft, £A18m, is lower and the operating expenses are less for the -138 version, which is also expected to be more suited to the airline's operating stage-lengths.

Mr. Townley, who commented that "technical experts are unanimous in their estimation of the Boeing as a safe, economical, highly competitive aircraft, the introduction of which will keep Australia in the forefront of international aviation," made it clear that the new overseas air communications service which would be available in 1959 would have a major defence value and that the long-range fleet could form the nucleus of an auxiliary air transport command.

Although, according to the views expressed by Sir Hudson Fysh in London recently, "airfields in Australia are all right," the consideration of such runway problems as do exist for the big jets is likely to be regarded as part of Australia's defence planning. Strategic considerations apart, Qantas is in a sound position (a nett profit of over £320,000 was made in 1955) to finance its latest purchase from annual earnings in dollar areas, and arrangements have been made to sell about six Constellations for dollars.

In *Flight* last week, before the Qantas purchase of 707s was announced, we recorded Sir Hudson's hopes that B.O.A.C. would be permitted to operate American jets. The Qantas chairman recently amplified this statement by emphasizing the interdependence of the two airlines. The connection which B.O.A.C. will establish with Qantas at San Francisco in April next year will be with DC-7Cs, and it is self-evident that with the introduction of Boeing 707s on the San Francisco-Sydney route an all-jet service in 1959 is greatly to be preferred.

I.A.T.A. IN EDINBURGH

THE twelfth annual general meeting of the International Air Transport Association opened in Scotland last Monday under a new president—Lord Douglas of Kirtleside—who took over office from Juan T. Trippe, the president of PanAm. Presidents and representatives of the Association's 74 member airlines were given a punch-by-punch report on the state of the international air transport system by Sir William P. Hildred, the director-general of I.A.T.A. The traffic-control, ground handling, industry, equipment, fares, finances and profit furniture of the airlines' house were

Short seats in long Viscount. The interior of the first V.802 is equipped with these comfortable Short Bros. and Harland lightweight seats, specially designed for B.E.A. They are stressed to withstand 9g and yet can be stowed against the cabin wall when freight is carried.

Surrounded by a large crowd at Peiping after an eight-hour flight from Moscow, the Tu-104 is now reported to be in regular service on the Moscow-Irkutsk route following an inaugural flight on September 15.

Sir William P. Hildred, director-general of I.A.T.A. (left), with the retiring president, Mr. Juan T. Trippe, and the new president, Lord Douglas of Kirtleside (right), at a meeting of the executive committee.

all picked up, shaken and dusted; and the responsibilities of airlines and governments to each other and to passengers in establishing fare levels were patriarchally re-defined.

Of the volume of equipment that is being bought for the next few years, Sir William plumped for a "just-right" conclusion, with the proviso that airlines would need to work hard—and soon—to make that answer possible. Discussing fares pared down to the lowest possible economic level, the director-general had this to say: "We have always acted on the assumption that prosperity will be with us; one day we may be wrong—I hope only slightly wrong—but with profits consistently cut to less than the bare minimum we would not be able to withstand for long any decline in traffic." [The airlines' overall profit margin is small indeed—1.1 per cent even excluding provision for taxation, development interest and possible dividends to shareholders. On purely international operations, I.A.T.A.'s 30 major airlines operate at an overall loss.]

Air traffic control also came under Sir William's spring-cleaning broom. "Allied to the unnatural and outmoded designation of airspace boundaries," he concluded, "is the even more unreasonable practice, which can only be termed a political expedient, whereby control centres in different states share the responsibility for controlling aircraft in the same airspace." The A.T.C. officer was not forgotten: "He should have as personal a part in the operation as the flight crew themselves . . . the proficiency of personnel must be raised to meet the more exacting requirements for efficient air traffic control. I do not expect much improvement until such time as the responsibilities of the air traffic controller are given full recognition."

Sir William was at his most vigorous in combating suggestions that I.A.T.A. was a cartel; it must be clear to the dimmest of wits, he suggested, that this could not be the case: "I repeat again that the only commodity I know the price of which has come steadily down over the last ten years is the airline ticket."

The five-day conference ends today. During the week, delegates were due to be given the opportunity of sampling the Napier Eland-Convair.

WHOSE BABY?

THE ponderings of the law have been lengthy indeed in attempting to resolve the territorial status of airborne aircraft. Learned legal bodies have been considering and studying the question since 1912. The problem is to determine the national law which is applicable in the event of an act taking place on board an aircraft which requires legal jurisdiction. Births, deaths, crimes and marriage may occur infrequently in the air, but they can start a legal headache when they do; the signing of a contract or a will may be a much more commonplace event, but as the law now stands it must be determined whether the act occurred on the territory of the State in which the aircraft was registered—known as the law of the flag—or that of the State over whose territory the aircraft was flying—territorial law.

A typical illustration of the complications presented by national laws intended to solve such matters is the apparently simple case of a birth which occurs during an international flight. In a British or a Belgian aircraft, the birth is considered to have taken place in Great Britain or Belgium respectively; but should the aircraft be flying over France at the time, the birth is considered by French law to have occurred in France. To increase the confusion, if the child's father is a national of a third State which provides that the nationality of the father is hereditary, the child may have no fewer than three legal nationalities or, in different circumstances, may have no nationality at all. In much the same way, crimes committed in the air may be subject to double penalties or leave the criminal outside the reach of justice.

The rapid growth and increasing speeds of air travel often make an ass of territorial law, for during the time that an act occurred the high seas or the territory of several States may have been traversed. Such problems are now being considered in Geneva by a sub-committee of the I.C.A.O. Legal Committee under the chairmanship of Mr. J. H. Beekhuis (Netherlands).

I.C.A.O. IN SESSION

EARLIER in September, a Joint Support Conference met in Geneva to revise the existing Danish and Icelandic arrangements on air navigation facilities. Under the terms of the Chicago convention on International Civil Aviation the provision of air navigation facilities and services is undertaken by each State on its own territory; but in certain instances, where the cost of financing and manning the installations would be disproportionate, "joint support" action is taken by I.C.A.O. in providing financial and technical aid.

Iceland is a case in point. The maintenance of airfields and air traffic control on a scale greatly exceeding the requirements of the two Icelandic airlines are essential to North Atlantic traffic, since airfields in the vicinity are required when strong headwinds make direct crossings possible only at reduced payload, and pressure-pattern flights routed northward require Icelandic alternates to be available. The geographical location of the island—situated as it is where the storm tracks converge and redevelop—makes it indispensable as an observation area for weather forecasting on the North Atlantic routes; its A.T.C. and flight information services are consequently fully utilized when meteorological conditions are unfavourable. In 1948, after an earlier joint support conference had been concluded, the cost of the necessary air navigation facilities was about £214,000 a year—a heavy burden for the island to bear alone—so the participants in the arrangement include ten other countries who make use of the facilities available.

Another conference at Geneva, originally called to allocate costs for existing systems of technical information, is now likely to extend until September 27 so that "special experts" can examine a proposal made by U.S. technicians for consideration of an international plan to use the V.H.F. radio system "forward Propagation Ionosphere Scatter"—analogous to the diffused reflection of a searchlight beam from cloud—which works efficiently under any atmospheric condition. They have also asked for the extension to the whole North Atlantic region of a new method of informing pilots exactly where they are at any given moment. This method (which may possibly imply T.A.C.A.N.) is already working at a few experimental stations in the United States and Canada.

BREVITIES

The possibility that Sydenham airport, which is much closer to Belfast, may be used in preference to Nutts Corner, is being considered. Big improvements are needed at the latter airport, which is nine miles from the city.

* * *

Butler Air Transport and Ansett Airways may shortly merge to form a third major airline in Australia.

* * *

The 74 member-airlines of I.A.T.A. will shortly use new labels on their air cargo. The "perishable goods" label shows a carcass of beef, a cluster of grapes, a fish and a flower, the four surrounding an hour glass with its sand running out. The "fragile" label is symbolized by a wine-glass and the label for "this side up" by a simple wide arrowhead.

CIVIL AVIATION . . .

T.W.A. will offer 97 flights and 5,000 seats weekly to European cities when the two-week excursion fares come into effect on October 1.

* * *

The Super-G Constellation *Rani of Nilgris* inaugurated the Air-India International Sydney to London *via* India service on September 7.

* * *

Following the lifting of restrictions by the U.S. Civil Aeronautics Board, Capital Airlines are using their Viscounts on four flights daily between New York and Chicago.

* * *

Members of the Channel Islands Air Advisory Council who regard the proposed 10 per cent increase in fares on the Channel Islands routes "with great concern" have protested to Mr. A. H. Milward, chief executive of B.E.A.

* * *

A Curtiss Commando of Jordan International Airways crashed two miles from the runway after taking off from Amman Airport on September 9. Although the aircraft caught fire 52 Arab passengers and the crew escaped; a young baby is missing.

* * *

Because the main runway at Manchester is too short and there is a lack of night landing aids, Lufthansa will discontinue the use of Manchester on its flights between Germany and Chicago. It is hoped to start again next spring.

* * *

A meeting of associate members of the Guild of Air Pilots and Air Navigators will precede the annual general meeting at the Innholder's Hall, 82 King William Street, London, E.C.4, at 4 p.m. on October 17.

* * *

Mr. Peter Bois, who for the past six years has been a senior Comet development test pilot, will leave de Havilland Aircraft at the end of this month to take up an appointment as chief advisory pilot to Swissair.

Mr. Max Stuart-Shaw, assistant general manager of Aer Lingus (left) and Mr. Clive Adams, general sales manager of B.E.A., exchange gifts and congratulations at the Imperial Airways Trainees' reunion dinner. Both have recently completed twenty-five years continuous air transport service.

The first transatlantic crossing carried out since an Air Charter Avro Tudor was re-classified as a Supertrader took place on September 6. The aircraft arrived at Stansted after having flown 2,350 miles non-stop from Gander.

* * *

From October 5 Aer Lingus plan to introduce special weekend excursions, at the winter single fare, for the return journey between Manchester and Dublin, and Birmingham and Dublin. Return fare from Manchester will be £4 19s and from Birmingham £6 1s.

* * *

Air France has ordered that its three long-distance flights to Madagascar and Mauritius shall no longer use Cairo Airport for a stopping point. The airline's two weekly flights from Paris to Cairo will continue. B.O.A.C. and B.E.A. will still use Cairo "for the moment."

* * *

A new airline, Transcontinental S.A., has been formed by Argentine businessmen. An international service will be flown between Buenos Aires, New York, San Francisco and the Far East with a fleet of five Super Constellations obtained on a rental basis. Services to New York are expected to start in May next year and to San Francisco in 1958.

FROM THE CLUBS

OFFICIAL inauguration of the Hertfordshire Police Flying Club (Popular Flying Association Group No. 87) took place on Sunday last, September 16. The club was formed in April, since when a Tiger Moth has been assembled by members under the supervision of a qualified engineer, and flying tuition has begun. All operating costs are being borne by the club members. The Chief Constable of Hertfordshire, Col. A. F. Wilcox, O.B.E., who performed the ceremony on Sunday, is president of the club, and Inspector T. A. Winser is chairman.

RE-FORMED last month to provide flying facilities for the London staff of the Vickers group of companies, the Vickers Flying School is now operating—using the facilities of the West London Aero Club—at White Waltham Aerodrome. Of the fifteen members (there are a further 17 on the waiting list at present), four have previous flying experience. Instruction is being provided by Miss Joan Hughes and F. H. McDouall of the West London Club.

The new club is the third to be established in recent years for employees of Vickers companies, the two forerunners being the Vickers-Armstrongs (Aircraft) club, whose members fly at Fair Oaks; and the Vickers Supermarine club (Thruxton and Eastleigh). The original Vickers Flying School was formed in 1911 with headquarters at Vickers House, Westminster, and flying base at Brooklands.

THIS year's date for the annual dinner-dance of the Surrey Flying Club has been announced as November 2. The function will be held this year at the Greyhound Hotel, Croydon.

FOLLOWING the initial success of the Tiger Club, the formation of a "Maggie Club," to cater for owners and pilots of Miles Magister aircraft, has been suggested. Those interested should contact David Ogilvy at Elstree Aerodrome.

IN the first newsletter of the Kronfeld Club, recently published, details are given of a course of twelve lectures on *Flight and the Atmosphere* which is to be held at the club on Thursday evenings beginning September 27. These lectures, which will be given by Frank Irving, M.Eng., and R. D. Scorer, M.Sc., Ph.D., have been arranged with the co-operation of the Department of Extra-Mural Studies of the University of London.

The object of the course is to discuss motions of the atmosphere which affect flight, the airflow in the vicinity of a flying machine and the forces acting on it. The relationship between the air motions and cloud forms will be examined, together with the causes of types of motion peculiar to the atmosphere. The lectures, illustrated with slides and films, will show the great extent to which properties of the atmosphere determine the design of aeroplanes, and how the speed of sound becomes a major factor in high-speed flight.

The fee for the course is £1 for members of the general public and 10s for members of the Kronfeld Club. As the number of places is limited by the size of the lecture room, applications and enquiries should be made as soon as possible (to the Secretary, Kronfeld Club, 74 Eccleston Square, London, S.W.1).

The first annual general meeting will be held on Friday, October 26 at 8 p.m. in the lecture room at the club, and will be followed by an informal party.

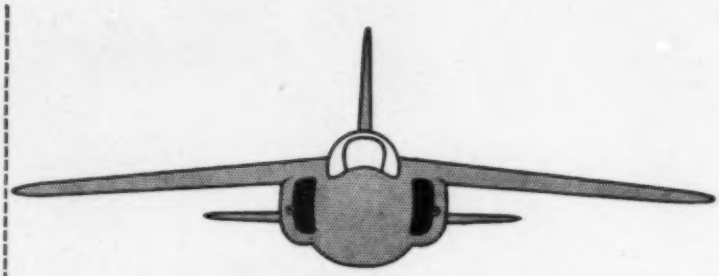
ANNUAL meeting of the Australian Women Pilots' Association was held at Brisbane over the weekend of September 7-9. Among the flying events was the 1956 Women's Air Reliability Trial and a navigational exercise organized by the Queensland Branch of the Association.

NEW colour scheme for aircraft of Denham Flying Club, revealed in the latest issue of the club newsletter, comprises "jewelescent" green (upper half) and silver (lower half), divided by a maroon flash. Dark glasses will be on hire at a modest rate, C.F.I. "Wilbur" Wright adds.

LAST month's Barber Cup Landing Competition at the Plymouth Aero Club was won by R. B. Holman, with J. Gilbert second and R. Hocking third. Flying instruction at Plymouth for midshipmen of the Britannia Royal Naval College, Dartmouth, will be resumed on September 24. First of a series of monthly guest nights at the club is planned for October 13.

AUGUST flying hours at Fair Oaks Aero Club reached the record total of 713, with instructors Ron Cobbett and Robin Brodie-James logging 130 and 112 hr respectively. Total paid flying hours for the first eight months of this year are 3,594. No fewer than 15 P.P.Ls and four first solos are recorded in the club's newsletter for August.

AERODYNAMIC investigations on a Slingsby Skylark 2 have recently been carried out at Lasham by a team from Imperial College led by Frank Irving. Special instrumentation was used to take drag and other measurements on the wing at various speeds, following release from Tiger Moth tows at 6,000ft.



INDIA HAS ORDERED THE GNAT

THE INDIAN GOVERNMENT, AFTER A CAREFUL STUDY, HAS CHOSEN THE GNAT FOR THE RE-EQUIPMENT OF THEIR AIR FORCE AND FOR MANUFACTURE UNDER LICENCE IN INDIA

This light jet fighter—half the size, a third of the weight and needing less than half the thrust of the conventional fighter—makes big savings in initial and operating costs yet matches the conventional fighter in the nature and duty of its essential equipment and in flying and fighting performance. In some respects—e.g., in rate of climb, manœuvrability and maintenance—it has conspicuous advantages.

FOLLAND *Designed and Built by the Pioneers of the Light Jet Fighter*

FOLLAND AIRCRAFT LIMITED · HAMBLE · SOUTHAMPTON · HANTS

Personally speaking

—a series of contributions on questions of the hour by leading international aviation personalities.

KNUT HAGERUP-SVENDSEN

Vice-President SAS and one of the authorities on trans-Arctic flight—contributes . . .

Trans-Polar Navigation

It is no new discovery that the shortest way between two of the world's great population centres crosses Arctic areas; but before opening the route for passenger service, SAS were faced with many problems, among which navigation was prominent.

The best navigational aid is still astro-navigation based on fixes, and since navigable stars are visible all 24 hours during the winter, this is the better time for flight. An instrument called "Kollsman's Polarised Sky Compass" has been evolved, which will give a bearing on the sun even when it is below the horizon, or hidden behind light clouds. This instrument is used by SAS

The directional gyro is used for maintaining direction in the area of the polar region where the magnetic types of compasses will not operate within 1,000 nautical miles of the magnetic pole. To determine the direction to be set into the directional gyro the astro-compass must be used.

The use of radio aids in polar navigation is limited—due to the scarcity of radio stations and magnetic storms and disturbances in the Aurora Zone. The North Atlantic and Greenland Loran chain provides cover over Greenland, Baffin Bay and Northern Canada, while the Consol stations at Bush Mill and Stavanger provide cover up to 70°N. between Greenland and Norway.

Airborne radar may be of immense assistance to the navigator in the polar region for taking drifts, computing speeds and wind calculations. The radar altimeter is used extensively when utilizing pressure position lines.

SAS has tackled all the navigational problems by now and has already gained great experience in Arctic flying. There is no doubt that trans-polar routes have the utmost possibilities and attractions.

AVIATION BP SERVICE

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The international aircraft fuelling organisation of
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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

After the drumhead service at Biggin Hill last Sunday, the Bishop of Woolwich led the procession from the open-air altar to the St. George's Chapel of Remembrance.

Battle of Britain Week

COMMEMORATING the 16th anniversary of the victory of "the few" in the Battle of Britain in 1940, this year's ceremonies and displays were varied and colourful, despite the poor weather and heavy Service commitments elsewhere.

During the week, the now traditional group of German and British aircraft of 1940 vintage was arranged on Horse Guards Parade, London; and a Sunderland of No. 201 Sqn. taxied up-river and lay at moorings off the Tower of London.

After several successful practice runs the Fighter Command fly-past, which was scheduled for Saturday morning, had to be cancelled because of low cloud over London. Three days earlier the Hurricane which was to have taken part met with a mishap at North Weald, and ground crews worked round the clock to repair it. Hawker's own Hurricane stood by to take its place if necessary.

On Saturday, also, 44 R.A.F. stations were open to the public and air displays were arranged. Once more the attendance record was broken and a total of no fewer than 1,333,300 people came to see them. This was 24,100 more than last year, when two more stations were "at home." The total was achieved in spite of rain, low cloud and cold winds in many parts of the country, which took toll of certain items in the flying displays. The highest attendance was again at Biggin Hill, where the crowd exceeded 200,000. Part of the air display was televised by the B.B.C. The next highest attendances were at Castle Bromwich, 160,000; Thornaby, 110,000; Wymeswold, 75,000; and Hendon and Horsham St. Faith, 70,000 each.

Following the traditional policy of interchanging aircraft between stations, a great variety of types was to be seen everywhere, either on the ground or in formations visiting groups of stations. Victors, Valiants, Javelins, Beverleys and Comets all appeared at many places. At Turnhouse, where 32,000 people attended, the Valiant made its first appearance in Scotland, and Vampires of No. 603 (City of Edinburgh) Sqn., R.Aux.A.F., flew past in "E" formation as a tribute to the Queen, who is the unit's Honorary Air Commodore. There, too, was the brilliant Hunter aerobatic team of No. 43 Sqn., and a Prestwick Twin Pioneer.

At Castle Bromwich, Spitfires, Hunters, a Comet, a Beverley, helicopters and a Provost were supported by a Comper Swift and a Britannia.

A single Spitfire from the Temperature, Humidity and Upper Air Measurements Flight, piloted by Mr. J. Formby and normally based at Woodvale, opened the display under a 1,500ft ceiling, with an easterly wind gusting up to 20 m.p.h. and in a brief shower. But the weather improved and the only cancellation was the parachuting.

In two-and-three-quarter hours there were 49 events. Outstanding was Johnny Williams, chief test pilot of Alvis, Ltd., who brought a Provost over from Baginton for an apparently effortless 95-second inverted fly-past which took him almost into the circuit of Elmdon airport, and left the crowd astonished. He could be seen in the distance rolling out, turning round, and flying back again inverted for 40 seconds. Then, almost over the airfield, he rolled out and immediately inverted once more, then flew off in that attitude for another 60 seconds towards Baginton. In practising for this display Williams had hung upside down continuously for 102 seconds with the Leonides behaving excellently; and on all the flights he carried an Alvis mechanic with him.

Horsham St. Faith gave a three-hour flying display in which a Hurricane took part. Low cloud cleared in time to allow four Meteors to give a fine show of formation aerobatics.

Certainly one of the most ambitious programmes was at Biggin Hill, where No. 111 Sqn. made brilliant use of the few gaps in low cloud to give an excellent exhibition of formation aerobatics with five Hunters. By contrast, a Sopwith Pup and a Bristol Fighter enjoyed a brisk dog-fight in a wind against which neither of them seemed able to make very much headway. Not so the Hunters and a Swift F.R.5, which made very fast runs. The wind precluded parachuting, but someone who must have been a very, very cold Home Command pilot made an excellent precision landing in a primary glider after being towed by a Chipmunk for several minutes. A most convincing demonstration of the efficacy of Martin-Baker's "runway ejection" was given (with a dummy) by the company's Meteor 7/8, and Peter Twiss flew past in the Fairey Delta 2 record-holder.

Altogether, over 40 items were offered, the show concluding when 11 Meteors of No. 600 (City of London) Sqn. "hit the blue notes" as they dived to attack a ground position which was subsequently overrun by troops of No. 2600 (City of London) Field Sqn., smartly disembarked from a Beverley. Similarly vigorous setpieces were enacted at several other airfields. At many stations, too, extensive static displays of aircraft and equipment were presented.

On Sunday morning the Bishop of Woolwich, the Right Rev. R. W. Stannard, gave the address at a drumhead memorial service at Biggin Hill. A field altar was flanked by a Spitfire and a Hurricane and music was provided by the Central Band of the R.A.F. A psalm of thanksgiving was read by Air Marshal Sir Thomas Pike, A.O.C-in-C. Fighter Command, and Sir Winston Churchill's famous tribute to the R.A.F. was read by the Station Commander, G/C. J. Barraclough. About 1,500 people attended.

In London on Sunday afternoon Air Chief Marshal Sir Dermot Boyle, Chief of the Air Staff, laid a wreath at the R.A.F. memorial on Victoria Embankment and a parade, commanded by G/C. S. B. Grant, marched down Whitehall to Westminster Abbey, escorting the Queen's Colour for the R.A.F. in the United Kingdom.

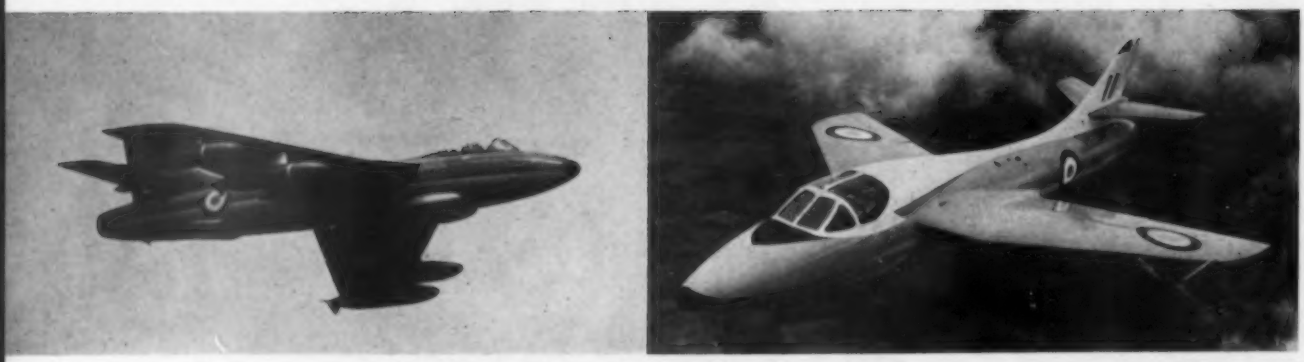
During the afternoon, Westminster Abbey was again the setting of a Service of Thanksgiving for the victory achieved in 1940. The service was conducted by the Dean, Dr. Don, and the Queen was represented by Air Chief Marshal Sir John W. Baker. Many members and former members of the Air Council were present, including the Chief of the Air Staff, Air Chief Marshal Sir Dermot A. Boyle, and his predecessor, Marshal of the Royal Air Force Sir William F. Dickson, accompanied by Lady Boyle and Lady Dickson.

After the clergy, choir and congregation had taken their places, the R.A.F. ensign was borne in slow time up the aisle from the great west door and laid by Dr. Don on the High Altar. The bearer was W/C. J. A. Hemingway, D.F.C., who fought in the Battle of Britain and is now O.C. Flying at Duxford. Supporting him were F/L. C. F. A. Curtis (No. 247 Sqn.) and F/L. R. J. Linford (No. 600 Sqn.).

The first lesson, taken from the third chapter of the first book of Maccabees, had in it passages singularly appropriate to the service: ". . . How shall we be able, being so few, to fight against so great a multitude and so strong, seeing we are ready to faint. . . . It is no hard matter for many to be shut up in the hands of a few; and with the God of heaven it is all one, to deliver with a great multitude, or a small company: for the victory of battle standeth not in the multitude of an host."

The sermon was preached by the Rev. F. S. Skelton, D.S.O., D.F.C., M.A., who took as his theme the comparison that, whereas in the Battle of Britain only a very few could take part, the many could fight for the things for which the few had fought and died.

After the Blessing, trumpeters sounded the Call of the Royal Air Force, the Last Post and Reveille, after which the Central Band, under W/C. A. E. Sims, played the R.A.F. March Past as the ensign was taken from the High Altar and marched in slow time back to the west door.



"Flight" photographs

Following steady development the Hunter is to be seen in a number of new forms. The F.6, above left, will carry four 100 gal tanks without performance limitations—or offensive stores—and the T.7, ordered in quantity for the R.A.F., carries two pilots and two guns.

SERVICE AVIATION . . .

CF-100s for Europe

FOUR CF-100 squadrons will soon move from Canada to join the Canadian 1st Air Division in France. In November No. 445 Sqn. will fly from Uplands, Ontario, to Marville, base of No. 1 Fighter Wing, where it will replace one of the three Sabre squadrons now based there. The other three squadrons will make the crossing during next year and one of them will be based at each of the Canadian airfields in Europe. About half the ground crew of each squadron will accompany the fighters in North Star transports, the remainder being drawn from personnel already in Europe. Code name for the ferry flights is Nimble Bat.

As each Sabre squadron is disbanded in Europe a new CF-100 squadron will take over its number in Canada so that the number of CF-100 squadrons in Canada will at no time be diminished. The first of the new all-weather squadrons is already forming and working up. In addition, a further three CF-100 squadrons will be formed to raise the Canadian total to 12.

Helicopter Paratroops

A NEW task for Whirlwinds of No. 155 Sqn., at Kuala Lumpur, Malaya, is the dropping of Special Air Service parachutists into the jungle. When the technique was being developed, initial drops were made with 200 lb dummies and live jumps were then made by troopers of No. 22 S.A.S. from 800 to 1,000ft at 10 to 15 kt. On operations each Whirlwind will carry two pilots, a dispatcher and three or four paratroopers.

NATO Minesweeping Exercises

FOR one month, ships of the British, Belgian, French, Netherlands, Norwegian and United States navies are working together in a prolonged minesweeping exercise in the North Sea. Last week vessels began assembling in British east-coast ports. Dummy minefields are being laid in Belgian, French and Netherlands waters and in open sea routes, and the minesweepers will attempt to maintain the flow of shipping. Forces will be harassed by attacks from fast patrol boats, Netherlands and British maritime aircraft and aircraft of 2nd A.T.A.F. An amphibious assault will be mounted by Netherlands marines on one of the Dutch islands.

No. 6209 Bomb Disposal Flight

DURING the last three years No. 6209 Bomb Disposal Flight, based at R.A.F. Bückeburg, has "immobilized" no less than 1,000 tons of bombs. The unit works for all NATO forces in Germany and runs training courses for Americans, Canadians, Dutch and Belgians. It has been consulted by the Germans and has assembled a museum of bombs and other lethal devices totalling over 200 exhibits. There are 72 types of British bomb, 51 American, 68 German, 13 miscellaneous objects—some of Russian origin—and 20 varieties of booby trap. Unique items include Russian explosive devices and electronic and radio-proximity equipment used in later types of German and Allied aircraft bombs. The flight is commanded by F/L. J. E. Moore.

In the past year operations have included the removal of a live German 500 lb bomb from beneath a British Army workshop, removal of a stick of 11 live H.E. bombs from beside a runway, the clearance of a live minefield next to an aerodrome, search and clearance of a German battle area pitted with unexploded mortar bombs, and the removal of an anti-tank missile from a fuel tank. Members of the unit, some of whom did this work during the London blitz, are all volunteers.

Senior Appointments

IT is announced that A.V-M. W. H. Merton is appointed A.O.A., H.Q. Bomber Command, and that A.V-M. J. G. Elton is to be Chief of Staff to the Head of the British Joint Services Mission in Washington with effect from November.

A.V-M. Merton was most recently C.A.S. of the R.N.Z.A.F. Before that he was A.O.C. No. 63 Group, Home Command, and A.O.C. No. 22 Group Technical Training Command. During the war he served in the Middle East for two years, first as a squadron commander and afterwards at H.Q. No. 257 Wing. In 1943 he commanded R.A.F. Luqa, Malta, and then became Assistant Commandant of the R.A.F. Staff College before going to Air Ministry as Director of Organization in 1946. He later commanded R.A.F. Mildenhall and Upwood, was Air Attaché in Prague, Deputy Director of Air Foreign Liaison at Air Ministry, and head of the R.A.F. delegation in Greece.

A.V-M. Elton has been A.O.A. at H.Q. Bomber Command since 1953, and was before that Air Attaché in Paris. He was commissioned in 1926 and served with Nos. 11 and 101 Squadrons at home, before going to Singapore in 1932 to serve with No. 36 Sqn. In 1939 he was a flight commander with No. 70 Sqn. in Iraq and then commanded No. 47 Sqn. in the Sudan. During 1942 he commanded Nos. 242, 238 and 248 Bomber Wings in North Africa before joining Coastal Command in this country. In 1947 he took the Imperial Defence College course and in 1948 became Deputy Director of Operational Requirements at Air Ministry. He was later Commandant of No. 1 School of Technical Training, Halton.

Reunions

THE tenth annual reunion for all members of No. 219 Sqn. and Nos. 6219 and 6029 Servicing Echelons, who operated with the Squadron, will be held at the Monarch Hotel, Bridlington, Yorks, on October 13. Tickets, price £1 5s, from F/L. P. Gilliatt, R.A.F. Driffield, E. Yorks.

The aircrew reunion of the Banff and Dallachy Strike Wings (Coastal Command) will take place at the Queen's Head, Denman Street, Piccadilly Circus, London, on November 24. Details from Geoffrey Mayhew, Autumn Cottage, Kettlewell Close, Woking, Surrey.

Like this brand-new production Victor, all V-bombers may in future be glossy white. The example seen here shows tail-warning radar, parallel-chord fin and rudder, single-piece leading-edge flap and extra windows in the cabin roof.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Bouquet for Blackbushe

THOUGH a regular reader of *Flight* I have so far, during the Farnborough Show period, seen no mention of the Blackbushe Airport effort. During most of the year the control staff's work is taken very much for granted, along with the other activities of the airport; but the hundreds of arrivals and departures during this week, together with normal flying operations, must throw a considerable strain on the control-tower staff. I do not feel that statistics need be published, knowing what a lengthy business it is to obtain permission from a Ministry to publish anything at all; but I am sure a "thank you" to the staff could raise no objections from any quarter.

I think it must be quite a good start for the visiting aircraft, especially the overseas element, to receive an efficient welcome at Blackbushe.

Camberley, Surrey. H. JOYCE.

Turboprop Economics

WHEN, in the early 1960s, the Boeing 707 and Douglas DC-8 enter service on the non-stop transatlantic route and others of similar stage length, it appears inevitable that the turboprop formula will be eclipsed as a first-class long-range transport proposition in the currently accepted sense which associates first-class air travel with the highest obtainable block speed. The turboprop cannot compete with the pure jet now in the realm of pure speed, and the gap between them is certain to widen in the future.

Where the turboprop can score is in economics, but if speed is given too much attention this virtue will be obliterated without corresponding gain. For too many years the accent has been on speed and yet more speed, while load-carrying has been sacrificed —an unwise policy, particularly in the case of this country. Is it not now time to face the fact that the proper sphere of the turboprop is economical load-carrying at speeds of not more than 400 knots and to stop chasing will-o'-the-wisps with thin wings and supersonic propellers? This pastime can only lead to bankruptcy.

If people are to be persuaded to travel by turboprop, there must be compensating advantages to offset the slower journey. Probably at the top of the list is cheaper fares—not just a few pounds cheaper but something of the order of a one-third to one-half reduction on corresponding pure jet fares. It is appreciated that fare structures are at present determined by international agreement, and not by the inherent economics of particular aircraft; but it is absurd that we should allow the turboprop, our particular speciality, to be put out of business by arbitrary rules designed for another age; and we must press for and, if need be, insist upon the necessary alterations. It is no good having aircraft with wonderful economics if the rules force you to charge fares which will keep in business less economic aircraft whose higher speed will then enable them to steal all the traffic.

Cheaper fares may not be the whole story, however. Is it not reasonable to suppose that there are many people who would elect to spend a slightly longer journey in the more comfortable and spacious surroundings which the turboprop could provide, rather than be carried a little faster in a kind of human toast-rack sealed in a giant toothpaste tube? This is surely the difference between air travel and mere transportation. The old flying-boats were popular precisely because of their superior accommodation. There is also the safety factor which favours the turboprop. So it is suggested that there is room for "First Class" passengers in long-range turboprop airliners once the idea is grasped that "First Class" means more than just high speed. After all, the Atlantic liners are still very much in business at speeds not much in excess of 30 knots! There is no need to despair of the turboprop, provided we do not try and make it perform tricks outside its repertoire. It is the natural complement rather than the rival of the pure jet, and it is up to us to see that it achieves its proper destiny.

Southsea, Hants. TORQUEMADA.

Veteran Skymaster

IT was interesting to read the brief history of the veteran Skymaster, constructor's serial number 3094, furnished by Sgt. D. F. Gilpin, H.Q. 2nd T.A.F., in your correspondence columns (*Flight*, April 6, page 400).

Sgt. Gilpin may be interested to learn that the old work horse is now flying in India and bears the registration letters VT-DIA. It was purchased in October 1955 by Indian Airlines Corporation from Air Vietnam and the registration markings changed from F-UNAN to VT-DIA. It is utilized for operation of the night air-mail services and flies regularly between Calcutta, Bombay, Madras, Delhi and Nagpur.

Calcutta. P. H. BHANOT.

IN BRIEF

With the support of the Air Ministry, Mr. J. W. R. Taylor is writing a history of the Central Flying School. He feels that during its 44 years' existence many episodes must have gone unrecorded, and asks if readers who have any good stories or pictures will get in touch with him at 36 Alexandra Drive, Surbiton, Surrey.

LEAR AUTOPILOTS FOR J-35s

A CONTRACT has been placed with Lear, Inc., of Santa Monica, California, for automatic flight-control systems for the Swedish Saab J-35. The installation will involve complete three-axis control and stability augmentation for the Swedish "double-delta" intercepter, which (powered by a Rolls-Royce Avon with afterburner) is reported to have achieved a high supersonic Mach number in level flight.

The Lear company has four manufacturing divisions in the U.S.A. and two in Europe, and was the first company to apply autopilots successfully to jet fighters in America. Lear autopilots are fitted to the French S.E.210 Caravelle and to the prototype of the Boeing KC-135 tanker/transport.

BLADE TRACKING IN FLIGHT

THE Kaman Aircraft Corporation of Bloomfield, Connecticut, has produced a device whereby a helicopter pilot can adjust the tracking of a two-bladed rotor in flight. Usually this process involves a crewman using flags and the making of manual adjustments while the machine is on the ground.

With the new device, pilots with no previous experience were able to realign blades which had been deliberately set out of track by as much as six inches. An evaluation programme of 70 hours has been successfully completed, and adjustments can be made at speeds up to 60 kt. The amount of adjustment possible is not sufficient to endanger the helicopter.

The pilot's tracking adjustment control is a small crank in the cockpit which, when turned, energizes an electric inching control. This offsets one of the bell cranks in the rotor control circuit, and the pitch of one blade of a two-bladed rotor can thus be altered to bring its track to the correct level. Movement of the inching control does not alter the position of the control levers in the cockpit. In Kaman's HOK-1 helicopter, one tracking adjuster is installed for each of the two rotors.

FORTHCOMING EVENTS

Sept. 19-21. R.Ae.S. and Institute of Physics: Conference, Cranfield.
Sept. 22-23. Women Pilots' Association: Flying Meeting, Sandown.
Sept. 23. Air Display, Frankfurt.
Sept. 25. Society of Instrument Technology: "Accurate Calibration of Flowmeters," by E. A. Spencer, B.Sc.(Eng.). Ph.D., A.M.I.Mech.E., and A. T. J. Hayward.
Sept. 25-29. 2nd European Aeronautical Congress, Scheveningen.
Sept. 27-28. Aerodrome Owners' Association: Annual Conference, Southampton.
Oct. 1. R.Ae.S.: Main Lecture at Derby: First Sir Henry Royce Memorial Lecture, by H. I. F. Evernden, M.B.E.
Oct. 4-5. Air Traffic Control Convention, Southend.
Oct. 6. British Interplanetary Society: "Study of the High Atmosphere in the International Geophysical Year," by Prof. H. S. W. Massey, F.R.S.
Oct. 9. R.Ae.S.: Section Lecture: "The Pressure Jet Helicopter," by A. Stepan, Dipl.-Ing.
Oct. 11. R.Ae.S.: Main Lecture at Henlow: "Rocket Motors," by S. Allen, F.R.Ae.S.
Oct. 16. Institute of Navigation: Annual General Meeting.
Oct. 17. R.Ae.S.: Main Lecture: "Importance of Time in Aircraft Manufacture," by Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.
Oct. 23. R.Ae.S.: Section Discussion: "Functional Efficiency of Aircraft," introduced by C. Abell, O.B.E., F.R.Ae.S., and A. V-M. A. F. Hutton, C.B., C.B.E., D.F.C.
Oct. 25-26. Aircraft Electrical Society: Annual Display, Los Angeles.
Oct. 26. College of Aeronautics: Tenth Anniversary Dinner, London.
Nov. 9-10. Agricultural Aviation Show, Palmerston North, New Zealand.

THE INDUSTRY

Tiltman Langley Reappointments

A NUMBER of changes in the Board of Tiltman Langley, Ltd., are announced. Owing to ill health, Mr. Marcus Langley is giving up the duties of managing director, but he will remain a director of the company and will resume his activities as soon as his health permits. Mr. A. Hessell Tiltman has been appointed president of the company and Maj. H. H. Sykes is acting managing director pending the appointment of a successor to Mr. Langley. Mr. L. A. Wingfield, M.C., D.F.C., has been appointed chairman following the resignation of Mr. W. R. Tomkinson, who became temporary chairman last November.

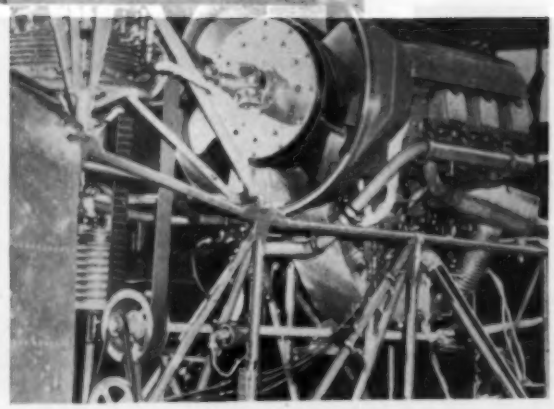
High-efficiency Transmission Belting

A FORM of power-transmission belting that has received wide acceptance in America is to be manufactured under licence in this country by the North British Rubber Co., Ltd., of Castle Mills, Edinburgh 3. The invention of the system earned for its originator—Mr. L. H. Case, of the Gilmer Division of the U.S. Rubber Co., with which the Edinburgh firm has close technical associations—the prized Edward Longstreth Medal of the Franklin Institute of Philadelphia.

The PowerGrip belt, as it is known, is an unusually thin belt, having as its load-carrying element a single layer of helically wound, high-tensile-steel wire cable, embedded in moulded neoprene. Based on this tension member are moulded transverse neoprene teeth. A jacket of neoprene-impregnated fabric provides a wear-resistant surface for the teeth as well as protection for the tension member. As the belt does not stretch, it is possible to maintain constant tooth pitch, and thus ensure positive engagement of the teeth with axially cut grooves in the pulleys.

It is stated that ratios of up to 30:1 are made possible, while the extreme flexibility of the belt permits pulley diameters as small as ½in and speeds as high as 10,000 r.p.m., even under heavy load conditions.

Aeronautical applications in which PowerGrip belts are being used include helicopter tail-rotor drives (as seen in the accompanying photograph), certain components of emergency hand-operated flight controls and retraction gear, and gyro drives and radar scanner drives.



An early application of the PowerGrip belt for a helicopter tail-rotor drive. The machine was the Canadian-built Sznycer-Gottlieb SG VI-D.

Tecalemit-Foamite Fire Tenders

THE firm of Tecalemit, Ltd., announce that their subsidiary, Foamite, Ltd., has been awarded a M.o.S. contract for crash fire tenders similar to the prototype built by Tecalemit, Ltd., and shown at Farnborough (illustration, page 409, *Flight*, August 31). These vehicles are on Thornycroft Nubian chassis powered with Rolls-Royce B8 engines; production is to begin shortly at the Plymouth factory of Tecalemit.

It is also announced by the company that Mr. D. G. Thorpe has been appointed sales manager, motor manufacturers and aviation department.

IN BRIEF

Mr. H. A. Champion has been appointed chief buyer of Bristol Aircraft, Ltd., as from September 1. He was formerly chief buyer of the Rodney Works, Bristol Aero-Engines, Ltd.

* * *

William Jessop and Sons, Ltd., announce that their London office has been moved to Crane Chambers, 118 Chancery Lane, London, W.C.2. The telephone number (Holborn 7145) remains unchanged.

* * *

Avica Equipment, Ltd., Mark Road, Hemel Hempstead, Herts, have prepared a comprehensive manual covering inspection and maintenance of their range of stainless-steel flexible-pipe assemblies. They have also started an after-sales service department.

* * *

Mr. A. J. Brunker, B.Sc.(Eng.), A.C.G.I., D.I.C., A.M.I.E.E., chief engineer of E. K. Cole, Ltd., has been appointed an executive director of the company. Mr. Brunker came to E. K. Cole, Ltd., in 1947 from the Ministry of Supply, where for several years he held the post of Deputy Director, Radio Production.

* * *

The Pullin Group of companies (among whose products are electrical turn-and-slip indicators, as used in Britannias and Comets, and relay systems employed in both these types and the Viscount) have opened West End showrooms. These are at Electrin House, 93-97 New Cavendish Street (between Bolsover Street and Titchfield Street), London, W.1.

* * *

The Kynmore Engineering Co., Ltd., Shirehall Park, London, N.W.4, have been appointed technical representatives in the U.K. for Novotechnik of Stuttgart, manufacturers of precision slip-ring assemblies. These devices, which have not hitherto been commercially available in this country, are used for transmitting electrical values from rotating parts to stationary instruments. They can be employed in cases where accurate measurement is required at high speeds, for example of the vibrations of blades in turbines and rotary compressors, or the temperature of rotating parts of compressors and turbines.

* * *

Simon Engineering (Midlands), Ltd., Dudley, Worcs, have set up a hire service in London, Birmingham and Manchester for their hydraulically operated maintenance platforms. The 30ft and 40ft models are available, mounted on a lorry, and charges include the services of an operator/driver.

* * *

Foundry Services, Ltd., of Nechells, Birmingham, are holding an "open week" from September 24 onwards at Drayton Manor, near Tamworth, Staffs, to mark the completion of their new works there. About a thousand of their foundry customers have been invited to inspect the plant during the week.

* * *

Venner, Ltd., have appointed three new directors. Lt-Col. Laurence Bingham, general sales manager, is now sales director; Mr. Edward Tauchert, M.I.Mech.E., general works manager, is works director; and Mr. W. H. Marsden, A.C.A., secretary of the company, is also a director.

* * *

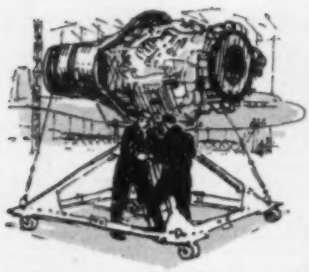
Muirhead and Co., Ltd., Beckenham, Kent, have announced an addition to their range of servos and synchros. This unit, known as the synchro type 15TR4a, is manufactured (like its predecessors) to U.S. Navy Bureau of Ordnance specification and is available for early delivery.

* * *

Cellon, Ltd., state that their licensees in Australia, Davison Paints, Ltd., of Auburn, Sydney, are now fully approved for the supply of the complete range of Cellon aircraft finishes. The Aeronautical Supply Co., Pty., Ltd., of Melbourne, already well known in Australian aviation circles, have undertaken sales and distribution on behalf of Davison Paints.

* * *

Warm sunshine and orchestral music helped to make a great success of a garden party held recently by Plannair, Ltd., in the grounds of their offices at Windfield House, Leatherhead, Surrey. Nearly 200 guests attended and were welcomed by the joint managing directors, Mr. J. R. Phillipson and Mr. V. A. Kennett, and the technical director, Mr. E. W. Rundle. Plannair, Ltd., are specialists in blower and air-compressor equipment for airborne and ground applications.



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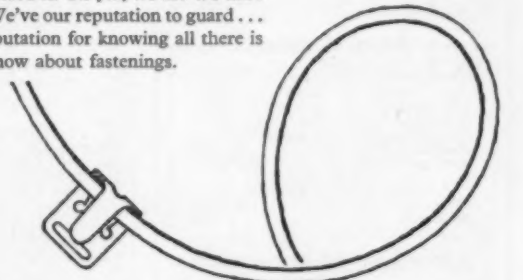

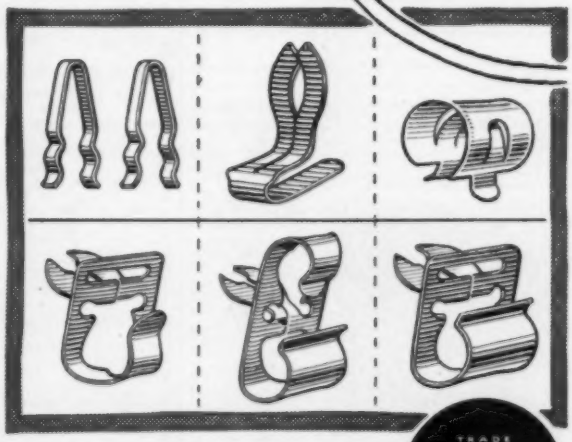

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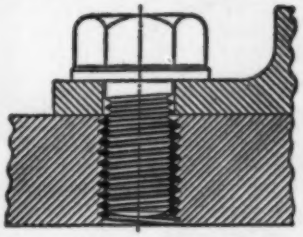

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 143/5. From Derby Aviation, Ltd., of Derby Airport, Burnaston, Derby, for an amendment to the terms of approval of the seasonal U.K. Internal Service which they are authorised to operate for the period up to September 30, 1959, on the route Nottingham and/or Derby-Wolverhampton (optional)-Birmingham or Southampton (technical stops)-Jersey, so as to include a traffic stop at Coventry (Baginton) on Sundays only.

APPLICATION No. 452/2. From East Anglian Flying Services, Ltd., of Southend Airport, Southend-on-Sea, Essex, for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate for the period up to July, 1962, on the route Ipswich and/or Southend-Rotterdam and/or Ypenburg, so as to extend the service to Dusseldorf.

APPLICATION No. 952. From Manx Airlines, Ltd., of Ronaldsway Airport, Isle of Man, for a Seasonal Normal Scheduled Service with Bristol 170 and D.H.89A aircraft and later possibly with D.H. Heron and/or Handley Page Herald aircraft, for the carriage of passengers, supplementary freight and mail between Newcastle (Woolsington) and Dublin (Collinstown) at a frequency of four return flights weekly during the season from April to October each year, for a period of ten years, commencing April 1, 1957.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [5729

PUBLIC APPOINTMENTS

SENIOR Scientific Officers: Scientific Officers. The Civil Service Commissioners invite applications for pensionable appointments covering a wide range of scientific research and development in most of the major fields of fundamental and applied science. In biological subjects the number of vacancies is small: individual vacancies exist in the National History Museum for candidates who have special knowledge of, or who are interested in, palaeobotany, malacology, helminthology, acarology, foraminifera, mammalian taxonomy.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

Interview Boards sit at frequent intervals.

Candidates taking their degrees in 1956 may apply before the result of their degree examination is known.

Age Limits: Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted; for Scientific Officers between 21 and 28 during 1956 (up to 31 for permanent members of the Experimental Officer class). Salary (London) Senior Scientific Officers: (men) £1,135-£1,345; (women) £1,026-£1,240. Scientific Officers: (men) £605-£1,055; (women) £605-£962. Women's scales being improved under equal pay scheme. Somewhat lower rates in the provinces.

Further particulars, for which early application is advised, from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S.53/56 for Senior Scientific Officers and S.52/56 for Scientific Officers. [5720

PUBLIC APPOINTMENTS

METEOROLOGICAL Office, Scientific Officers. The Civil Service Commissioners invite applications for permanent posts. Early application is advised. The duties include research in atmospheric physics, covering the study of cloud structure, synoptic and dynamical meteorology, large and small scale diffusion and turbulence, climatology, and development of instruments. There is a limited number of posts for forecasting work at the more important centres. Successful candidates will be given a course in meteorology before being assigned to a research or forecasting establishment for further training and experience. In some instances candidates with national service obligations can be commissioned in the R.A.F. for forecasting duties at R.A.F. stations. Further information may be obtained from the Director, Meteorological Office, (M.O.10), Air Ministry, Kingsway, London, W.C.2.

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Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

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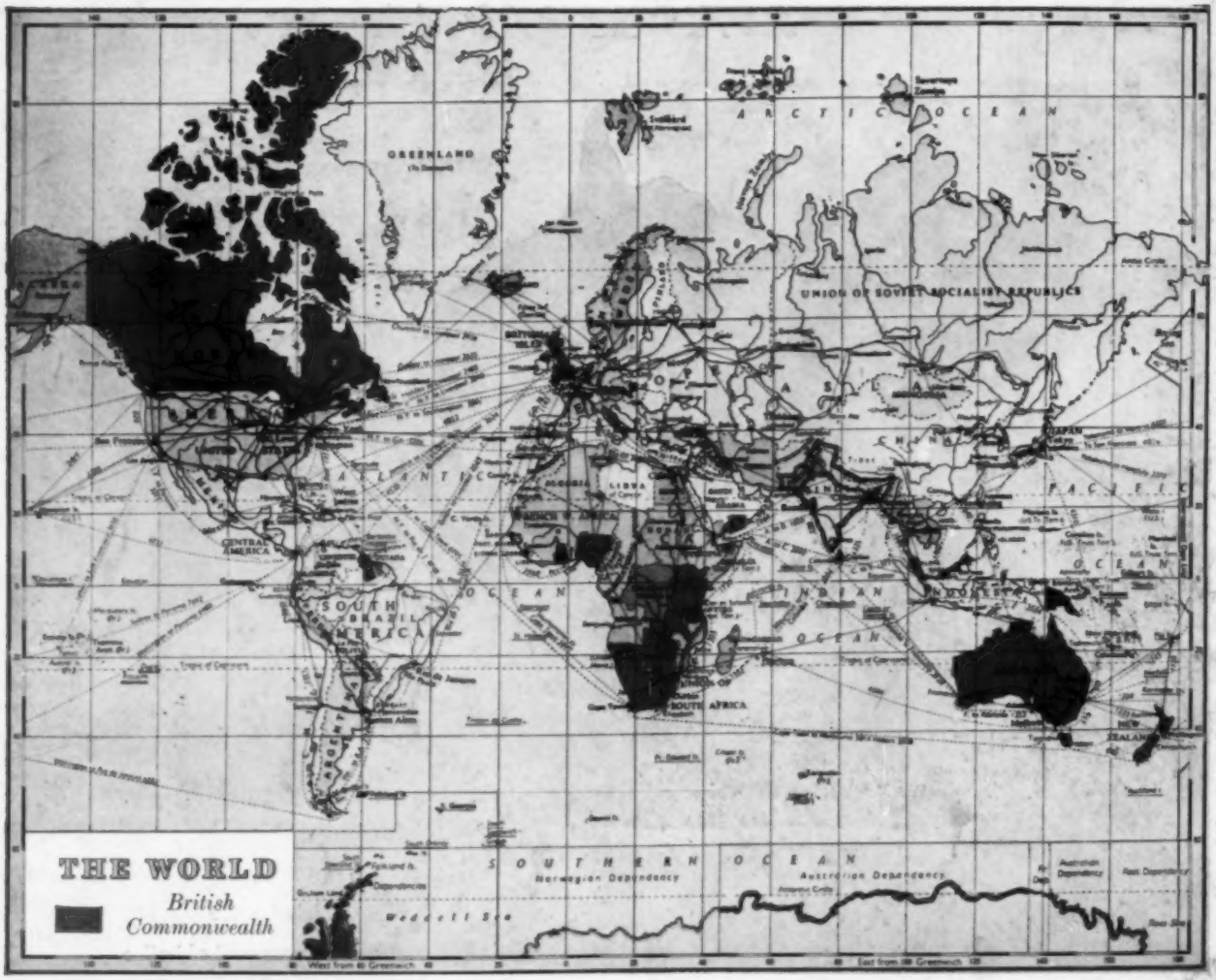

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